Metals Review
THE NEWS DIGEST MAGAZINE
Volume XXIII • No. 4 April 1950

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Professor of Physics, Amherst College

TABLE OF CONTENTS

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Metals Review

THE NEWS DIGEST MAGAZINE

RAY T. BAYLESS, Publishing Director | MARJORIE R. HYSLOP, Editor | GEORGE H. LOUGHNER, Production Manager

VOLUME XXIII, No. 4 | APRIL, 1950

A.S.M. REVIEW OF METAL LITERATURE

New Classification System

Starting in 1950, a new classification system has been adopted for the ASM Review of Metal Literature. It is based on the ASM-SLA Classification of Metallurgical Literature, described in the February issue of* Metals Review. *Below are the titles of the main sections of the classification, together with the page numbers in this issue. The scope of each of these sections was explained in the classification outline published in February.

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Prepare now to enter the fifth

METALLOGRAPHIC EXHIBIT

to be held at the National Metal Congress and Exposition in Chicago, Oct. 23 to 27, 1950. Rules are simple and few; there are no restrictions as to size or method of mounting. A large area in the exhibition hall has been reserved so the entries can be displayed to best advantage.

RULES FOR ENTRANTS

Work which has appeared in previous Metallographic Exhibits held by the American Society for Metals is unacceptable.

Photographic prints shall be mounted on stiff cardboard, each on a separate mount. Each shall carry a label giving:

Name of metallographer
Classification of entry
Material, etchant, magnification
Any special information as desired

Transparencies or other items to be viewed by transmitted light must be mounted on light-tight boxes wired for plugging into an ordinary lighting circuit, and built so they can be fixed to the wall.

Exhibits must be delivered between Oct. 1 and Oct. 20, 1950, either by prepaid express, registered parcel post, or first-class letter mail.

Address: Metallographic Exhibit
c/o W. H. Eisenman
National Metal Congress and Exposition
International Amphitheater, Chicago, Ill.

CLASSIFICATION OF MICROS

1. Cast Irons and Cast Steels
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3. Irons and Alloy Steels (excluding Stainless) in Wrought Condition
4. Stainless and Heat Resisting Steels and Alloys
5. Light Metals and Alloys
6. Heavy Nonferrous Metals and Alloys
7. Powder Metals (and Carbides) and Compacts
8. Weld Structures (including brazed and similar joints)
9. Series of Micros Showing Transitions or Changes During Processing
10. Surface Phenomena and Macrographs of Metallurgical Objects or Operations (2 to 10 diam.)
11. Results by Non-Optical or other Unconventional Techniques.

AWARDS AND OTHER INFORMATION

A committee of judges will be appointed by the Metal Congress management which will award a first prize (a medal and blue ribbon) to the best in each classification. Honorable Mentions will also be awarded to other photographs which, in the opinion of the judges, closely approach the winner in excellence.

A Grand Prize, in the form of an engrossed certificate, and a money award of $100 will be awarded the exhibitor whose work is adjudged "best in the show", and his exhibit shall become the property of the American Society for Metals for preservation and display in the Sauveur Room at the Society's Headquarters.

All other exhibits will be returned to owners by prepaid express or registered parcel post during the week of Oct. 29, 1950

Entrants living outside the U. S. A. will do well to send their micrographs by first-class letter mail endorsed "May be opened for customs inspection before delivery to addressee".

32nd NATIONAL METAL CONGRESS AND EXPOSITION

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Investment Casting and Powder Metallurgy Methods Compared, Illustrated

Reported by Kenneth B. Lloyd
Research Project Metallurgist
University of California

The contrasting processes for parts production by the investment casting technique and by powder metallurgy methods were discussed by Richard D. Potter at the Feb. 13th meeting of the Golden Gate Chapter A.S.M. in San Francisco.

Dr. Potter, formerly a research worker and staff member at M.I.T. and now professor of metallurgy at the Berkeley campus of the University of California, pointed out that "extra properties" are frequently obtained from the alloys employed for precision casting by the wax pattern method. These extra factors, he felt, come principally from the better "housekeeping" provided by personnel in producing such castings rather than from any inherent advantages involved in the investment method.

The lecture on castings was amply fortified by many mounted and labeled sample castings, wax patterns, wax pattern clusters, and clusters of castings. These examples served to illustrate advantages and limitations of the casting process and to indicate reasons for the economic applicability to the parts shown.

Powder metallurgy products were also exhibited on sample boards, and in this section of the lecture Dr. Potter described the principles, advantages and limitations of the method. A film provided further illustration.

The economic aspects of both methods, as applied to the San Francisco Bay Area, were pointed up in the discussion period, when it developed that no plant in the area presently produces either product.

Harry E. Lewis of Dexter Metal Treating Co. presided in the absence of Chapter Chairman I. R. Leheney, and presented the new Constitution and By-laws to the members of the Chapter.

Top Officers at Detroit

Bad Weather in Detroit Failed to Dampen the Spirits of A.S.M. National Officers. Left to right are Vice-President W. E. Jominy, a member of the local chapter; President A. E. Focke; and Secretary W. H. Eisenman

Reported by H. H. Benninger
Peninsular Steel Co.

February 13 will probably be remembered for quite some time by the national president and secretary of the American Society for Metals. In addition to marking the date of their appearance at the Detroit Chapter, the morning of February 13 ushered in the worst weather seen in Detroit for two years. In spite of 9 in. of slush and continuous sleet and rain, however, a capacity audience turned out.

At the conclusion of the dinner Secretary Eisenman reviewed the position of the A.S.M. as a technical society. He emphasized the enviable position held by the metallurgist in industry today.

President Focke discussed "Tempering of Steel" with particular emphasis on those features of tempering that are often neglected. His unique manner of presentation, which calls for active audience participation and a free, easy manner on the part of the lecturer, was well received.

Heart Attack Takes H. W. Gillett, First Battelle Director

Horace W. Gillett, 66, former director of Battelle Memorial Institute, died from a heart attack on March 3, while returning from a hunting trip in Florida and Georgia.

Dr. Gillett was responsible for the technical organization of Battelle Institute and was its first director from 1929 to 1934. At the time of his death, he was serving as a technical consultant to Battelle, having retired as chief technical advisor in early 1949.

Horace Wadsworth Gillett attended Cornell University, receiving his A.B. degree in chemistry in 1906. Following graduation, he taught physical and electrochemistry at Cornell while working on the requirements for his doctorate degree, which he received in 1910. In the same year he was made manager of the research department of the Aluminum Castings Co., Detroit.

In 1912, he became associated with the U. S. Bureau of Mines as an alloy chemist, and 12 years later, he succeeded George K. Burgess as chief of the Division of Metallurgy, U. S. Bureau of Standards. In 1929, Dr. Gillett was chosen to head the newly founded Battelle Institute. In the same year he accepted the editorial direction of *Metals and Alloys* now known as *Materials and Methods*.

A scientist rather than an administrator by inclination, Dr. Gillett resigned from his directorship of Battelle in 1934. From then until 1949, he acted as chief technical advisor. In this capacity, he passed upon every technical report and research paper that left the Institute.

In addition to his Battelle duties, Dr. Gillett found time for extensive writing and participation in the research activities of professional societies. During the recent war, he served on the Advisory Committee on Metals and Minerals to the War Production Board and as a member of the research division of the War Metallurgy Committee.

Common Ground Between Theory and Practice Pays Dividends in Machining

Reported by D. J. Girardi
Metallurgical Department
Timken Steel and Tube Division

Looking for the common ground between metallurgical theory and machining practice pays large dividends. J. D. Armour, chief metallurgist, Union Drawn Steel Division of Republic Steel Corp., presented this viewpoint at the March 13th meeting of the Canton-Massillon Chapter A.S.M.

The metallurgist who must deal with problems in machinability is often at a disadvantage because he is not sufficiently well versed in machining practice to correlate his metallurgical knowledge with the mechanics of machining. In an effort to overcome this deficiency, the speaker many years ago sold the idea of buying an automatic screw machine for the laboratory, with the hope of finding some common ground between metallurgical theory and machining practice. This point of view has paid dividends, for the metallurgist and the mechanical man working together may arrive at a solution for problems that neither could reach working alone.

Three Metallurgical Factors

While the metallurgy of machinability may be considered from many angles, the speaker divided it into three factors: *(a)* the ferrite matrix; *(b)* carbides in their various structural forms; and *(c)* inclusions—both those incidental to steelmaking practice and those resulting from intentional additions to improve the machinability of the steel. In most machining operations on steel the tool is primarily cutting through the ferrite matrix. However, the carbides and inclusions present can have a profound and variable effect on the ultimate machinability of the steel.

Hardness, ductility and coefficient of friction are the principal properties of ferrite that affect machinability. An explanation was offered for the effect of carbides in their various structural forms on machinability, based on the theory of the probability of carbides coming in contact with the tool. This theory offers an explanation of the observed differences in machinability between heat treated steels, spheroidized steels and steels with structural forms of carbides between these two extremes. In discussing the effect of inclusions on machinability, Mr. Armour stated that both aluminum and silicon deoxidation have an adverse effect on machinability, with aluminum being the worst offender.

The machinability of stainless steels was discussed, with special emphasis on the inherent seizing properties of stainless steels and the unusual work hardening characteristics of the chromium-nickel types.

Mr. Armour completed his talk with a reference to the theory of tool life. Each steel, he said, has a critical machining speed and feed, and attempts to exceed this critical speed and feed will result in a sharp loss in tool life.

Unusually good coffee entertainment was supplied by a 20-voice men's chorus from the Canton Music Workshop.

Compliments

To DOEHLER-JARVIS CORP., and H. H. DOEHLER, chairman of the board, on the appropriation of $50,000 for the installation of die casting machines in four technical schools, namely, Massachusetts Institute of Technology, Rensselaer Polytechnic Institute, Case Institute of Technology, and Illinois Institute of Technology.

To PAUL SCHWARZKOPF, president of American Electro Metal Corp., on the presentation of the Sixth Annual Medal Lecture sponsored by the powder metallurgy laboratory of Stevens Institute of Technology.

To LYNN A. FILL, chief engineer of Motor Products Corp. for 34 years, on his election as president of the American Society of Body Engineers, Inc.

To NICHOLAS A. ZIEGLER, research metallurgist, Crane Co., on the award of a silver medal in a national competition for amateur painters. Dr. Ziegler's prize-winning water color represented "a martensitic structure converted into a Russian icon".

To WALTER M. GAGER on his retirement after 34 years with E. I. du Pont de Nemours & Co. as service field metallurgist in the salt bath treatment of metals. Mr. Gager will henceforth engage in specialized consulting service in Niagara Falls, N. Y.

Gives Talk on Titanium

Reported by Howard E. Boyer
Chief Metallurgist
American Bosch Corp.

"Titanium", the newest engineering material, was the subject of the Feb. 20th meeting of the Springfield Chapter A.S.M. Howard C. Cross of Battelle Memorial Institute delivered an interesting lecture on this metal, from which an entirely new family of alloys has been produced. Mr. Cross's lecture was reported in the March issue of *Metals Review*, page 7.

Smallest Cold Strip Mill Seen in Plant Making Bottle Caps

Reported by H. L. Sittler
Metallurgist, Arcrods Corp.

The intricate processes involved in manufacturing bottle caps from hot rolled strip were viewed by members of the Baltimore Chapter A.S.M. in a plant visit on Feb. 20. Crown Cork and Seal Co. was host to the group, and while time did not permit inspection of the entire plant, the members were shown that part of the process starting with continuous pickling of the hot rolled strip, cold rolling, annealing, rerolling, tinning, shearing to size and stacking. A brief glimpse of the lacquering prior to lithographing was also sandwiched in.

After the inspection trip, Charles Glock of the host company described the processes in detail. The continuous pickling line for hot rolled strip, he said, was designed and built by Crown Cork engineers because commercially available equipment could not be fit into the space available. The five-stand tandem cold strip mill is probably the smallest—certainly the smallest as far as space occupied is concerned—in the world. Minimum strip thickness produced is 0.0065 in. and the maximum is 0.0245 in., with the average at about 0.0095 in.

The cold rolled strip then goes either to continuous annealers or to batch-type annealers. Both types of annealing are done in controlled atmospheres. It is necessary, however, to anneal to a slightly different hardness in the continuous annealer than in the batch annealer in order that the strip from the two processes will behave similarly when the crowns are formed from it.

The continuous annealer is unique in that the strip does not come to a stop in the heating and cooling zones. A "bank" of strip is carried on rolls at the entrance end of the furnace. This bank feeds steel into the furnace while a new coil of strip is being joined onto the last end of the preceding strip. Likewise a bank of rolls takes up the strip at the exit end when a coil is completed and while it is being removed from the take-up block.

The large electrolytic tinning tanks are also equipped with these banks of sheet at each end so that the strip is not stopped in the tinning bath. Either satin finish or a bright tin finish can be produced. The tin coating is quite thin so it can take the rather severe forming operations incidental to the production of bottle caps. The tin provides a suitable base for the lacquer which in turn provides a base for the lithography and also protects the content of the bottle from the steel of the cap.

THIRTY YEARS AGO

After a short life as independent organizations, the Steel Treating Research Society and the American Steel Treaters Society merged in 1920 to form the present American Society for Metals. The early issues of the official publications of these two societies (1917-1920) are filled with nostalgic and historical associations. — Ed.

—30—

The Pittsburgh Section of the Steel Treating Research Society was organized on Feb. 10 with W. H. PHILLIPS of the R. D. Nuttall Co. as chairman. Mr. Phillips was later elected a national president of the A.S.M., and at the time of his death in 1947 was vice-president in charge of sales for Molybdenum Corp. of America.

—30—

Another new group of the same vintage was the Hartford Section, also headed by a member later to become a national president—namely, F. P. GILLIGAN, then and now with Henry Souther Engineering Co.

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The first meeting of the Indianapolis Section was addressed by W. R. CHAPIN of E. C. Atkins & Co., who in 1936 was awarded the society's Albert Sauveur Achievement Medal "for fundamental work in connection with two-stage quenching of steel".

—30—

The Northwest Chapter of the American Steel Treaters Society was launched in 1919 with the blessings and assistance of the Manufacturers' Association of Minneapolis. ALEXIS CASWELL, secretary of that association, served as secretary-treasurer of the chapter from the beginning until his retirement in 1947, and continued to maintain an active interest in the society until his death in June 1949.

—30—

An early loyal supporter of the organization was LUDLUM STEEL CO., carrying sustaining memberships (then known as patron memberships) in five of the seven local chapters—Chicago, Philadelphia, Cincinnati, Cleveland and Buffalo.

—30—

Elected to succeed Founder Member WILLIAM P. WOODSIDE as president of the Steel Treating Research Society for 1919-20 was Prof. JOHN F. KELLER of Purdue University ("the learned blacksmith"). L. A. DANSE of Cadillac Motor Car Co. (at present supervisor of materials and proccesses, production engineering section, General Motors Corp.) was elected first vice-president, and HOWARD STAGG of Halcomb Steel Co. of Syracuse (now merged with Crucible) was second vice-president.

Atmosphere Generator Has Adaptability for Varied Heat Treatments

Reported by C. W. McKee

Test Engineer, Midvale Co.

Philadelphia Chapter had one of the largest turnouts of the season on Jan. 27 to hear Norbert K. Koebel, director of research, Lindberg Engineering Co., lecture on the latest developments in controlled-atmosphere heat treating.

An atmosphere generator of universal use today in heat treating departments that handle medium, high-carbon, and toolsteels, scalefree and free from decarburization, is the high-temperature endothermic gas cracking type. Nonmetallic catalytic cracking retorts have been developed, which permit a gas cracking temperature of 2200° F. At this temperature, precision cracking or splitting of the hydrocarbon molecule of the fuel gas with air will produce a protective atmosphere of 40% hydrogen, 20% carbon monoxide, 0.5% methane, and balance nitrogen. Since the reaction is not one of combustion or partial combustion (as occurred in the earlier types of generators), the harmful constituents of carbon dioxide and water vapor are not formed, and there is no need for purification or drying of the gas. Traces of moisture from 0.093 to 1.00% can be precisely controlled, and measured by a dew point meter, to place the generated atmosphere in equilibrium with steel of any carbon content.

The same generator can be used for low, medium, high-carbon, and tool and die steels including high speed. By adding either 5% propane or 10% natural gas, the atmosphere from the endothermic generator makes an excellent gas for deep case carburizing. By using the endothermic atmosphere as a carrier gas, the carbon content of the case can be controlled, and faster carburizing results because of the elimination of soot on the work.

If 20% anhydrous ammonia is added to the above endothermic gas, with the same additions of propane or natural gas used for carburizing, dry cyaniding can be performed in any good atmosphere furnace. Because of such adaptability, one large high-temperature endothermic generator can be made to serve as a central-station atmosphere unit to provide the basic atmosphere for all the furnaces in the heat treating department.

The economics of dry cyaniding by atmosphere instead of case hardening by salt cyanide were discussed, and the savings, both direct and indirect, of the former method were pointed out.

The most recent development for the heat treatment of high speed steel is a furnace in which the preheat, high heat, and quench are combined into one unit, Dr. Koebel continued. This design permits perfect control of the atmosphere within the furnace, and since the high speed steel does not contact air until after it has been preheated, high heated, and quenched to 150° F., bright hardening free from any traces of decarburization can be obtained. A unique feature of the design is the protective atmosphere quench which produces full hardness at a quenching rate that eliminates any danger of cracking and greatly reduces distortion.

The lecture was closed with a discussion of the problem of bright hardening the heat treatable types of stainless steels. The lecture was well illustrated with lantern slides and sample parts.

New Casting Techniques Give Close Dimensions

Reported by J. M. Loiacono

Eclipse-Pioneer Division
Bendix Aviation Corp.

Most casting difficulties are traceable to improper scientific analysis of the basic physical aspects of the casting process, proclaimed H. H. Harris, president of General Alloys Co., at a recent meeting of the New Jersey Chapter A.S.M. His subject was "New Developments in the Casting Field".

A group under Mr. Harris's direction which is at present investigating the various elements of casting practices is taking nothing for granted, he said. This development program, Mr. Harris indicated, has started to show some outstanding progress.

High-alloy materials have been cast with very good dimensional control and surface finish. A finish of about 25 micro-inches in the as-cast condition was reported in some cases. A sample casting with 10 to 20 micro-inch finish was exhibited.

New techniques include the use of ceramic molds of controlled porosity, graphite molds, improved venting and feeding methods. While these improvements are still in the development stage, it was indicated that industrial application is not too remote.

Corrosion Processes on Copper Explained

Photographed Prior to the February Meeting of the Texas Chapter A.S.M. Are (From Left): W. A. Kuenemann, Chapter Chairman (Houston Lighting & Power Co.); George C. Chatneuff (District Manager, Bridgeport Brass Co.); Harold Schmid, Vice-Chairman (General Metals Corp.); C. Lawrence Bulow, Speaker of the Evening on Corrosion of Copper Alloys (Research Chemist, Bridgeport Brass Co.); and M. W. Phair, Chapter Secretary-Treasurer (Tennessee Coal, Iron and Railroad Co.)

Reported by Leland V. Dolan

Dolan Industrial Sales

Hydrogen sulphide, sulphur dioxide and other corrosive gases will corrode metals faster when under high pressures than under low pressures. An exception is wet CO_2 which has less corrosive action on copper with increasing pressure.

These and similar problems in corrosion of copper and copper-base alloys were explained in a talk to the Texas Chapter A.S.M. at the February meeting by C. L. Bulow, research chemist of the Bridgeport Brass Co. Adding 0.1% arsenic to copper alloys increases the resistance to water corrosion threefold, he said.

A slide showed the lower half of a horizontal brass water pipe that was corroded by foreign matter settling out of the water. Another slide showed that the upper half of the same pipe was clean. Two solutions to this problem were offered: One, to use filtered water; the other to increase the velocity of the water. Particles of foreign matter like bits of metal, dirt, or even cotton lint, cause the start of corrosion, the speaker pointed out. These same particles, transferred to clean surfaces, can start corrosion, in a manner similar to the transfer of germs to healthy tissue.

Other points covered by Mr. Bulow were inhibitors, crevices, effect of temperature and biological activity, sea water fouling and corrosion. Various charts showed the accelerated effect of corrosion when metal is under stress in the presence of certain specific corrosive media.

Open Powder Metal Lab

John D. Shaw, Walter V. Knopp and Catherine L. Clark have severed their connections with Stevens Institute of Technology to establish a firm of consulting engineers known as S-K-C Research Associates with laboratories at 445 Fifth Ave., Paterson 4, N. J. They plan to do experimental research and development work as well as consulting in the field of powder metallurgy.

Adoption of Welding in Foundry Promotes Use Of Castings in Assemblies

Reported by W. P. Wallace

Department of Engineering
University of California

Hugo W. Hiemke, consulting welding and metallurgical engineer, and president of California Alloy Products Co., addressed a joint meeting of A.S.M. and the American Foundrymen's Society in Los Angeles, Feb. 10. Speaking on "The Use of Castings in Welded Assemblies", he pointed out that castings have some important advantages over fabricated parts. For example, parts can be cast with complex contours, they may be made from any special composition, and can be produced with desirable directional properties. Each of these points was illustrated with slides.

However, according to Mr. Hiemke, these advantages alone do not insure more future business for the foundries. Steel foundries particularly should set up welding shops in conjunction with their other facilities. This procedure would encourage inclusions of castings in assemblies. The welding techniques utilized in the foundry, Mr. Hiemke warned, should be based on modern metallurgical knowledge, such as the function of preheating and postheating, carbon and manganese equivalents as a guide against cracking tendency, and use of low-hydrogen electrodes.

John E. Wilson of Climax Molybdenum Co. acted as technical chairman for the evening. Prior to the meeting, members of the American Foundrymen's Society set up exhibits of various castings to illustrate what can be done in this field.

Lightner to Receive McFarland Award

M. W. Lightner, manager of the research and development division of Carnegie-Illinois Steel Corp., has been selected to receive the annual David Ford McFarland Award for Achievement in Metallurgy established last year by the Penn State Chapter A.S.M. Presentation of the award will be made at the second annual award banquet of the chapter on May 5 at the Nittany Lion Inn, State College, Pa.

"Max" Lightner received his B.S. in metallurgy at Pennsylvania State College in 1929, and his Master's degree in 1930 at Carnegie Institute of Technology. As research engineer of the Metallurgical Advisory Board at Carnegie Tech. from 1930 to 1933, he was associated with C. H. Herty, Jr., in the early work on physical chemistry of steelmaking.

M. W. Lightner

At Carnegie-Illinois Steel Corp. from 1933 to 1942, he held various jobs as chief metallurgist, assistant openhearth superintendent, and assistant to the general superintendent in charge of ordnance. He later served as director of research and vice-president of operations at the Heppenstall-Eddystone Corp. He was engaged in the construction and operation of a 10-million-dollar forging plant of the Bureau of Ships of the Navy Department.

In his present position, he directs and coordinates all research and development work of Carnegie-Illinois Steel Corp., involving all the processes and products of the steel industry.

Mr. Lightner has published numerous technical articles and has a number of patents to his credit. He is active in various other technical and professional societies, in addition to A.S.M.

Mr. Lightner will present the technical address of the evening on "Speeding Metal Refining Operations". Requests for banquet reservations should be directed to F. C. Krug, 539 East Beaver Ave., State College, Pa.

Various Aspects of Corrosion Treated in Purdue Symposium

Reported by Earl J. Schafer
Aluminum Co. of America

Various phases of the corrosion problem were presented to approximately 85 members and guests of the Purdue Chapter in a corrosion symposium on Feb. 21. H. J. Yearian, professor in the physics department of Purdue University; F. L. LaQue, in charge of the corrosion engineering section, development and research division, International Nickel Co.; and R. B. Mears, manager of the research laboratory of Carnegie-Illinois Steel Corp., were the speakers.

Dr. Yearian discussed the nature of surface films found on iron-chromium alloys as revealed by X-ray and electron defraction methods. Electron micrographs of the films were shown.

On alloys containing up to 26% chromium, and at various temperatures in atmospheres containing oxygen, α Fe_2O_3 is shown to be present in the films formed under all conditions. Where the rate of film formation is low, a Cr_2O_3-type component is also found. Where the rate of film formation is high (lower chromium content and higher temperatures), a spinel-type component is found in addition to the Fe_2O_3.

Interpretation of this spinel as possibly containing some chromium, although the lattice parameter agrees with that of Fe_3O_4, was discussed, as was a spinel of larger parameter found on the 26% alloy.

Mr. LaQue described various forms in which corrosion occurs, showed slides illustrating what they look like, and related what can be done to eliminate or minimize them. Dezincification of brass was described as "autocatalytic"; it is best inhibited by additions of arsenic, phosphorus or antimony.

Intergranular attack was illustrated by weld decay in austenitic stainless steels. Reduction in susceptibility to this type of attack is gained by quenching from a high temperature, by additions of titanium or columbium, or by reduction of carbon content.

Stress-corrosion cracking occurs in all alloys, Mr. LaQue said. In brass it is known as season cracking, and in steel as caustic embrittlement. Although theories have been advanced to explain intergranular stress-corrosion cracking, less is known about transcrystalline stress-corrosion cracking, such as occurs in stainless steels and magnesium alloys.

Impingement attack, commonly found in condenser tubes where turbulent water flow is encountered, is characterized by horseshoe pits. The pits are believed to be the result of preferential removal of the protective film formed by the corrosion product.

Various causes of localized corrosion were enumerated by Dr. Mears. Experimental work with both iron and aluminum has demonstrated, qualitatively and quantitatively, that localized corrosion is electrochemical in nature, he explained.

Differences in oxygen concentration are frequently responsible for potential differences and resultant localized corrosion. Difference in amount of agitation of solutions will frequently render the metal area in the less-agitated solution anodic.

Applied alternating current will cause localized corrosion of aluminum sheet, although similar tests on iron showed no effect. A scratch, breaking the surface film, will serve as an anodic area. Temperature differences from spot to spot in the solution will render the material in contact with the hot solution anodic.

Metal at a particular distance from a weld frequently suffers localized corrosion unless the welded article has been annealed after welding. An edge of a piece will often be anodic to the flat surfaces.

Stress-corrosion cracking is a potentially dangerous form of localized corrosion. Tensile and not compressional stresses are required for this type of corrosion.

Hear Case President on Democratic Principles

Reported by Robert D. Wylie
Babcock & Wilcox Co.

Sustaining Members' Night at the Akron Chapter A.S.M. was the occasion for a talk by T. Keith Glennan, president of Case Institute of Technology. Dr. Glennan's subject was "Private Responsibility", a timely one under present economic conditions. He left the membership with seven suggestions which the people of the United States should use to defend our democratic system against attacks from within. Dr. Glennan's seven suggestions are:

1. Know what our democracy is. Think about this problem and set your convictions firmly in your pattern of living.
2. Keep faith with democratic principles and practices.
3. Don't trade your political freedom for material security.
4. Don't expect the Government to give you something for nothing.
5. Defend the other man's stake in democracy as well as your own.
6. Be for a definite democratic program.
7. Participate in political, governmental and all community affairs.

With these seven suggestions Dr. Glennan cautioned the members of the chapter that the only way to avoid a socialistic economy is by prompt and concerted action on the part of those "who believe in private responsibility and the continuation of our American democratic system".

Chapter Awakens Interest in A.S.M. By Two Expedients

A recent upsurge in new memberships in the North Texas Chapter of the Amercian Society for Metals is attributed by Chapter Secretary Arthur C. Willis not to an organized membership drive but primarily to an awakened interest in the society. This interest has been bolstered by two factors.

First is the educational course on "Corrosion" presented during the month of March. The course was offered free of charge to members of the society in good standing. Nonmembers were charged a $5 registration fee which could be applied against the first year's membership dues in the society, if desired. Sustaining members were permitted to enroll up to five nonmember employees at no cost. Students of an accredited college or university were admitted free of charge.

The course consisted of five weekly lectures starting March 2 and ending March 30. Subjects and speakers were as follows:

Fundamentals of Corrosion, by Norman Hackerman, University of Texas.

Pipeline Corrosion, by T. R. Statham, Magnolia Pipe Line Co.

Aircraft Corrosion, by Norman H. Simpson, Consolidated Vultee Aircraft.

Oil Field Corrosion, by Fred Prange, Phillips Petroleum Co.

Preventive Measures, by H. E. Waldrip, Gulf Oil Corp.

Registrations for the course totaled 103 and attendance averaged 75. The chapter membership rose from a total of 87 on March 1 to 98 on April 1.

A second factor contributing to the chapter's membership increase is the encouragement given to present and prospective sustaining members, according to Secretary Willis. One method of serving the sustaining members was the sponsoring of an exhibit for "Sustaining Members' Night" held on March 15. In this exhibit each sustaining member was provided with floor or table space to display the company's products, services to industry and literature available.

President Focke at Buffalo

Reported by G. F. Kappelt
Metallurgist, Bell Aircraft Corp.

Practical use of radio-isotopes in metallurgy was the enlightening subject of a talk by Arthur E. Focke before the Buffalo Chapter A.S.M. at the March meeting. This dinner meeting held in honor of Dr. Focke, national president of the society, was attended by well over 100 members.

Metallurgical Cycle At Present Centers In Casting Field

Reported by James M. Loiacono
Eclipse-Pioneer Div., Bendix Aviation Corp.

Progress in the metallurgical field seems to occur in cycles, T. C. DuMond, editor of *Materials & Methods*, told the New Jersey Chapter A.S.M. at a recent meeting. His topic was "New Developments in Metals".

The present cycle appears to be centered around the casting field, Mr. DuMond observed. Precision casting methods, centrifugal casting, ductile cast iron, the use of ceramic and graphite molds, and pressure die casting techniques have figured prominently in recent developments.

Of particular interest is a new pressure die casting technique. As applied to aluminum alloys, this method involves the heating of the dies to about 1100° F. before the melt is poured into the die at about 1400° F. Pressure of the order of 3200 to 4200 psi. is used. Strength and ductility are improved over ordinary sand casting or die casting methods. Surface finish and dimensional control are good. This casting method is applicable to aluminum alloys, brasses, bronzes and steels. Many compositions previously used only for wrought materials are said to be castable by this method. Inserts can be cast into parts without difficulty.

The use of ceramic molds and graphite molds for centrifugal casting is giving promise for the production of castings with extremely fine finishes.

Turning to another field, Mr. DuMond discussed "hot-spot" machining. In this method difficult alloys are made readily machinable by heating to approximately 1500° F. during the machining operation. The heat is furnished by induction, gas or other common means. Machinability for some alloys can be increased approximately 300%. Lower temperatures (500 to 1000° F.) may be used but the improvement in machinability is lessened.

Much progress was reported in the production of cold extrusions from low-carbon and alloy steels, using crystalline phosphate coatings as lubricants. A new French extrusion process is claimed to produce finish-formed gears.

Steel Warehouses Service Industry as Vital Source Of Supply, Panel Shows

Reported by C. L. Rohrbaugh
Metallurgist, Naval Ordnance Plant

The steel warehouse industry was singled out for the first time by York Chapter A.S.M. for recognition in the form of a panel discussion at the February meeting. "Steel warehouses serve a function in large and small industry equally as important as the mills producing the steel," said C. F. Courtney of Peter A. Frasse and Co., Inc., who served as technical chairman and introduced the five speakers on the panel.

"Through the years, as the mills improved their techniques of steelmaking, the steel warehouses have kept pace by improving their stocks, distributing methods and services, to the point that today they are responsible for the marketing and distribution of between 18 and 20% of the yearly steel output in this country," Mr. Courtney continued. "This amounts to approximately 9 million tons of various types of steel."

The panel discussion, he explained, was planned to further the knowledge of metallurgists, engineers and purchasing personnel, of the facilities offered by steel warehouses. Stocks and types of steel immediately available from warehouses were listed by the panel speakers, and the types of services rendered by warehouse personnel were outlined. The speakers and their subjects were as follows:

The American Iron & Steel Institute Steel Classification — A. P. Seasholtz, Seasholtz Metallurgical Service.

Steels Used Without Heat Treatment—Edward Browne, York Steel Co.

Pre-Heat Treated and Stress-Relieved Steels—Arthur Belden, Crucible Steel Co. of America.

Steels to Be Heat Treated—Don Livingston, Hill Chase Co.

Stainless Steels—C. R. Eppinger, Horace T. Potts Co.

Officers on "Red Flannel" Circuit

Pictured at Milwaukee Chapter's National Officers' Night .1re (From Left): National Secretary W. H. Eisenman, J. L. Frey, Assistant to General Works Manager, Allis-Chalmers Mfg. Co., Chapter Chairman; and National President A. E. Focke of Diamond Chain Co., Inc.

Reported by R. M. Bach
American Steel & Wire Co.

During the swing around the "red flannel" circuit, President Arthur Focke and Secretary William Eisenman met with members of the Milwaukee Chapter, where National Officers' Night was observed on Jan. 24.

After Chapter Chairman Muir Frey welcomed the national officers, President Focke awarded 25-year membership certificates to five regular members and two sustaining members of the chapter.

President Focke presented an excellent technical lecture on "Mechanical Testing and Wear Testing", emphasizing the reasons for testing, how much to test, and correct interpretation of results to obtain a true measure of a product's usefulness. He also discussed the use of radioactive isotopes in wear testing investigations, and briefly touched on the shear-stress concept which helps to explain why the same metal may be brittle or tough, depending upon its prior history, form of test piece, method of loading, rate of loading and temperature.

Prior to the president's talk, Secretary Eisenman spoke briefly on the status and general affairs of the Society.

Visits Metal Centers in Spain

F. R. Morral, associate professor, department of materials engineering, Syracuse University (meeting reporter for the Syracuse Chapter A.S.M.), has recently returned from a two-week visit to Spain, where he did some work on a Spanish reference book on metallurgy with Dr. Jimeno of the University of Madrid. While there he also visited several industrial plants and research laboratories, and addressed meetings of some Spanish technical societies.

Nickel-Containing Alloys Useful for High Temperatures

Reported by D. W. Grobecker
Metallurgical Engineer
Los Alamos Scientific Laboratory

High-temperature alloys of the Ni-Cr, Fe-Cr, and Fe-Ni-Cr compositions—with minor additions of other elements to impart special properties—formed the subject presented by E. N. Skinner, research and development division, International Nickel Co., before the February meeting of the Los Alamos Chapter A.S.M.

Although cobalt-base alloys are more satisfactory for the higher temperature ranges, the alloys utilizing nickel have found wide usage in high-temperature applications, the speaker said.

At elevated temperatures, the strength of alloys is usually evaluated in terms of resistance to creep or to rupture. Extrapolations of relatively short-time laboratory data to stresses consistent with long-time service requirements are valid only in the absence of structural alterations in the alloy or deteriorating effects due to corrosion by the high-temperature environment.

For this reason, it becomes necessary to place at least equal emphasis upon an alloy's resistance to high-temperature corrosion by oxidizing, carburizing, nitriding, sulphidizing, steam or halogen-containing atmospheres. In general, it is desirable that oxides and other corrosion films increase in thickness as a parabolic or logarithmic function of the exposure time, since the corrosion product then has a protective action. Spalling of a corrosion film by blistering, shear cracking or flaking results in continual exposure of new metal and rapid corrosion loss.

The resistance of an alloy to attack at high temperatures by carburizing, nitriding or halide atmospheres depends generally upon the resistance of the component metals, Dr. Skinner explained. Although a hydrogen atmosphere normally is considered unreactive with the alloy compositions discussed, wet hydrogen at high temperatures may have a disastrous effect on certain alloys under conditions such that preferential chromium oxidation will take place, with oxide formation at the grain boundaries. Alloys to be used in sulphur-containing atmospheres must be low in nickel to avoid the formation of the low-melting sulphide eutectic.

Dr. Skinner closed his discussion with the observation that metallurgists today "have their backs against the wall" in the high-temperature field. Although there are less-common metals and alloys capable of withstanding higher temperatures than the alloys he discussed, there is little expectation of finding cheap, metallurgically tractable materials that will satisfy designers in their quest for greater heat resistance.

Study of Single Crystals Shows Metal Solidification

Reported by A. R. Deir
Dominion Bureau of Statistics
Department of Trade and Commerce

The solidification of metals was explained by Bruce Chalmers, University of Toronto, at the monthly meeting of the Ottawa Valley Chapter, held on Feb. 7.

Dr. Chalmers illustrated his talk with charts he had compiled from his study of single crystals of metal made by slowly lowering the temperature below the freezing point. Many hypotheses were advanced as to how atoms build up into a nucleus.

The speaker was introduced by H. H. Bleakney, who acted as technical chairman.

Practical Heat Treating Is Theme at Northwest

Reported by Knox A. Powell
Research Engineer
Minneapolis-Moline Co.

Practical heat treating was the theme of the January meeting of the Northwest Chapter A.S.M. E. J. Pavesic, metallurgist of the Lindberg Steel Treating Co., spoke on "Practical Tool and Die Hardening". As a prelude, "Heat Treating Hints", a 16-mm. color and sound movie portraying actual heat treating operations, was shown.

Mr. Pavesic's dissertation covered various factors which affect the heat treatment of tools and dies, ranging from bar stock and forging to the finished product.

Transformation characteristics of an oil hardening toolsteel and its relationship to martempering or interrupted quenching and straightening practice were discussed in detail. The temperature range of martensite formation is affected by the austenitizing temperature, Mr. Pavesic showed; the higher the austenitizing temperature, the lower the range of martensite formation is depressed. In this respect, excessive austenitizing temperatures enhance the retention of austenite and increase cracking hazards.

Size change on similar test rings of a chromium-tungsten oil hardening steel was shown to be a function of cooling rate when these rings are martempered, oil quenched and brine quenched.

Also discussed and illustrated were several examples of tools and dies of complicated design and the methods by which they can be heat treated. Case histories of cracked parts were presented and the cause for cracking revealed.

Corrosion Environment Related to Composition

Reported by Sam F. Carter
American Cast Iron Pipe Co.

The corrosion of steels depends upon both environment and composition, according to C. P. Larrabee of Carnegie-Illinois Steel Corp., in his talk before the Birmingham Chapter A.S.M. in February.

Extremes in environment are more influential than variations in composition, the speaker pointed out. Types of environment were described as atmosphere, natural water, soil, and chemical solutions. In general, industrial atmospheres are most corrosive, marine next, and rural atmospheres least corrosive. When metals at a marine location are subject to frequent wetting by sea-water spray, the corrosion is sometimes more severe than in any industrial atmosphere. The locations and operations of several test sites were described and illustrated.

The texture of the rust formed is an important factor in corrosion life. The improvement of atmospheric corrosion resistance by various concentrations of alloying elements was shown graphically. Small concentrations of copper appreciably improve resistance to atmospheric corrosion. Chromium, nickel, and phosphorus show slight improvement as their concentrations increase.

Coatings such as zinc, lead, aluminum, and paint can be used to protect surfaces. Mr. Larrabee stressed the importance of surface preparation and showed graphs relating corrosion life to the thickness of coatings.

In a natural water environment copper is not so effective as in atmospheric exposure. A 2 to 3% concentration of chromium is more effective.

Steel Founders Launch Special Research Project

As part of its extensive research program, Steel Founders' Society of America has initiated a special project directed to investigating and evaluating all known information on the removal of excess metal normally developed in the production of steel castings.

The project will study the varying methods of metal removal for gates, risers, feeding pads, fins and other minor protuberances normally encountered. Experimental studies are being carried out in a selected steel foundry, with the cooperation of a recognized engineering and research organization. Member foundries are contributing individual experience records and pooling information on equipment and design changes. The project is being carried out under direction of Charles W. Briggs, technical and research director.

Metal Cutting and Lubricant Problems Challenge Research

Reported by G. W. Birdsall
Reynolds Metals Co.

A wealth of experience on all types of metal cutting problems was reflected in the talk presented by William H. Oldacre, president, D. A. Stuart Oil Co., before the February meeting of the Louisville Chapter A.S.M. Mr. Oldacre's company is only one of many institutions now carrying out research programs on metal cutting and metal cutting compounds, he pointed out. Much is yet to be learned concerning the mechanism of edge penetration and of lubrication and chip formation.

Study to date reveals that chip formation is the result of metal flow, because flow lines are readily apparent in almost any chip when sectioned, etched and photographed to show structure.

In discussing the various types of cutting compounds, he pointed out that water mixtures have several advantages: They maintain lower temperatures in chip and work, are less objectionable to operators, are more easily cleaned from the work, and are low in cost. Counteracting disadvantages are: They allow the tool point to run hotter, produce a sharper temperature gradient in tool and work, they evaporate nonuniformly, have low viscosity with poor lubrication quality, and are less easily reclaimed.

The hot spot at the extreme tip of the cutting edge is also cooled less effectively with ordinary water mixtures because they are poor coolants at temperatures above the boiling point of water. This helps account for the fact that high-speed heavy-duty grinders work better with oils and that less sparking is produced.

The speaker described some of the work done with various types of lubricant testing machines. While these machines are useful for studying and evaluating various specific phenomena, they are entirely unsuitable for determining the best cutting fluid. Many other factors besides lubrication must be taken into account for a good cutting fluid, and these are not evaluated by testing equipment available today.

Finances Sigma Phase Study

A $1300 research grant has been made to Illinois Institute of Technology by the Allegheny Ludlum Steel Corp., Brackenridge, Pa., for fundamental research in sigma phase formation in heat resisting steels. The study will be undertaken by Ahmed El Bindari, graduate student in metallurgical engineering.

National Officers Visit Worcester

National Officers' and Sustaining Members' Night Was Held by the Worcester Chapter A.S.M. in February. Left to right are Chapter Chairman Orum R. Kerst, National President Arthur E. Focke, Secretary W. H. Eisenman, and George W. Motherwell, works manager of Wyman-Gordon Co.

Shows How Toolsteels Of Five Types Respond To Various Treatments

Reported by F. J. Welchner
Metallurgist
Canton Drop Forging & Mfg. Co.

Peter Payson of Crucible Steel Co. of America, well-known for his work and publications on steel metallurgy, presented the topic of "Tool and Die Steels" before the February Meeting of the Canton-Massillon Chapter A.S.M. His talk was illustrated by slides showing microstructures and thermal diagrams.

Of the many types and compositions of toolsteels available today, Mr. Payson selected five representative types: water hardening, oil hardening, air hardening, high speed, and hot work. Each type successively contains more alloys to produce higher hardenability and wear resistance.

The hot work types are designed to give better toughness at working temperatures than obtainable with the high speed types. Increasing temperatures dissolve greater amounts of carbides. The hardening temperatures vary with the different types of steel because of the differences in solubilities of their corresponding carbides. It is necessary to dissolve these carbides to an appreciable degree in the austenite of the steel so that the carbon can be effective in producing a hardness of Rockwell C-65 or over in the final heat treated tool.

Small grain size should be maintained so as to give adequate toughness. High speed steels should be annealed before re-heat treating; otherwise a pronounced grain growth takes place.

The cooling rate between the range of about 1300 to 900° F. is critical—too slow cooling within this zone will result in low hardness.

The effects of martempering and austempering were explained with the use of TTT-diagrams.

The double temper in the treatment of high speed steel, Mr. Payson explained, may be considered as a "conditioning" of the retained austenite by precipitation of alloy carbides in the first temper, followed by transformation to martensite during the cooling; and a tempering of the martensite in the second temper.

The talk was preceded by a cocktail party given by Crucible Steel Co. and after-dinner entertainment by Jimmy Ray, magician.

Philadelphia Entertains Sustaining Members

Reported by E. K. Spring
Chief Metallurgist
Henry Disston & Sons

Sustaining members of the Philadelphia Chapter A.S.M. were entertained at dinner on Feb. 24, with a goodly representation of the sustaining companies in attendance. Following dinner the lighter side of the evening's entertainment was provided by a local representation of the "Barber Shop Quartets".

A serious but nontechnical talk was then given by L. F. Livingston, manager, extension division, E. I. du Pont de Nemours and Co. Speaking on "Preview of Progress", Mr. Livingston revealed the amazing extent of controlled long-range research planning. Exhibits demonstrated various products that have resulted from such research.

New Members of Quarter Century Club

The following A.S.M. members have been awarded honorary certificates commemorating 25 years' consecutive membership in the society:

Buffalo Chapter—George J. Armstrong, W. R. Breeler, Theo. H. D. Burke, George F. Comstock, Walter Crafts, J. R. Dawson, G. Walter Esau, W. M. Gager, Robert M. Gamble, T. W. Knight, A. D. Potts, William H. Wills. Sustaining memberships: Simonds Saw & Steel Co. (C. R. Pafenbach, representative); J. H. Williams & Co. (J. A. Over, representative).

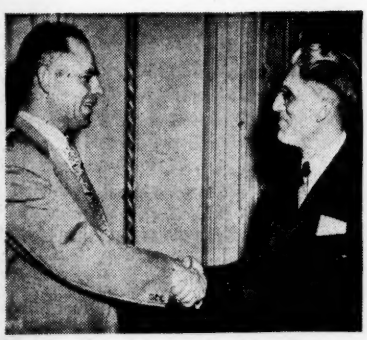
Syracuse Chapter—Malcolm E. Cummings, R. L. Manier, H. H. Mattison, C. T. Patterson, Howard J. Stagg, Jr., Martin E. Sutphen, Arthur E. Thurber, S. B. Voorhees, F. C. Wheeler. Sustaining membership: Crucible Steel Co. of America (R. A. Schneid, representative).

Howard Cross Is Cleveland Speaker

Reported by J. P. Long, Jr.
Thompson Products, Inc.

A most informative evening was provided by Howard C. Cross on Feb. 6, speaking before the Cleveland Chapter A.S.M. on a subject of current interest, namely, "Manufacture and Properties of Titanium". Mr Cross is chairman of the Columbus Chapter, and supervising metallurgist, Battelle Memorial Institute.

Through factual discussion and technical data supported by slides, Mr. Cross summarized the early history, production methods, mechanical and physical properties, and applications of titanium-base materials. Mr. Cross's talk was reported in detail in the March issue of *Metals Review*.



Dan White (Left), Engineer, National Advisory Committee for Aeronautics, Acted as Technical Chairman at the February Meeting of the Cleveland Chapter. At right is H. C. Cross of Battelle, the principal speaker. (Photograph by K. D. Sherman)

Oxygen in Steelmaking Saves Time, Fuel

Reported by Philip C. Barr, Jr.
Pennsylvania State College

G. M. Yocom, assistant to general manager, Steubenville Works, Wheeling Steel Corp., presented an interesting and timely talk on the use of oxygen in metallurgical processes to the Penn State Chapter A.S.M. on Jan. 10. Prior to the lecture a motion picture provided by Linde Air Products Co. was presented. It showed applications of oxygen in direct decarbonization of openhearth melts and also in the heating flame.

Use of oxygen for increasing production rates in metallurgical processes is relatively new, with much to be learned yet from the accumulating data, Mr. Yocom said. Nevertheless, present results show two distinct advantages of using oxygen in the bath for reducing the carbon content—namely, the more rapid carbon drop saves time and the increase in bath temperature saves both fuel and time.

The increase in the rate of carbon drop is particularly valuable when the desired carbon content is very low and difficult to reach because of low temperatures and decreased bath activity. Mr. Yocom explained the economics of using the 0.30% carbon as a starting point for the oxygen lance.

He also discussed the use of oxygen for combustion and the effect it has upon production. Recommended pipeline sizes and pressures employed to serve each of these operations were cited.

While the miraculous results first indicated on supervised furnaces are not attained on a battery of unsupervised furnaces, the use of oxygen provides decided savings in time and fuel, the speaker concluded. He warned, however, that other facilities for charging furnaces and handling the product must be speeded up to meet the 20 to 30% increase in production rate for the entire shop.

Lippert With Titanium Metals

A new enterprise, known as Titanium Metals Corp. of America, with offices in New York City, will distribute titanium metal in various forms. The firm is jointly owned by National Lead Co. and Allegheny Ludlum Steel Corp.

Thomas W. Lippert has been appointed general manager of Titanium Metals Corp. Mr. Lippert is a graduate of Carnegie Institute of Technology, with a B.S. and M.S. in physics, and was for many years editor of *Iron Age* and a director of the Chilton Co. Recently he was editor of *Journal of Metals* and also manager of all publications for the American Institute of Mining and Metallurgical Engineers.

W. J. Reagan (Left) Is Associate Professor of Metallurgy at Pennsylvania State College. G. M. Yocom (right), assistant to general manager, Steubenville Works, Wheeling Steel Corp., addressed the January meeting. (Photo by Penn State Engineer)

Vacuum Techniques Give Metallurgist a Useful Tool

Reported by C. L. Rohrbaugh
Metallurgist
U. S. Naval Ordnance Plant

"Another tool for metallurgists" was the phrase used by James H. Moore to describe "High Vacuum Techniques in Metallurgy" before the York Chapter A.S.M. Mr. Moore, who is director of metals research department, National Research Corp., addressed the March meeting in Lancaster, Pa.

Vacuum metallurgy is becoming an important tool in industry for providing high-purity metals and working with them. High-temperature and low-pressure operations, reduction of ores, melting and casting of metals, and coating of nonmetallic materials with metals are the principal applications of the process in quantity production at the present time. Minor uses and possibilities include distillations such as dezincification of lead, heat treating of metals, sintering, hot pressing and brazing.

Tilting-type and bottom-tapping furnaces, induction heated by motor generator sets, are used in production of melts up to 500 lb., Mr. Moore stated. Arc heating has also been used successfully in small or experimental furnaces. In production of metal-coated materials, units are in operation running 500 ft. per min.

The talk was adequately illustrated with lantern slides of data showing the relationship between temperatures and pressures used for reduction and separation of various metals. Equipment such as pumps, furnaces and complete units used in melting and casting was also illustrated.

Classification of S-Curves Into a Few Main Groups Proposed and Explained

Reported by Sheldon Rideout
Research Assistant
University of Notre Dame

Highlighting the February technical session of the Notre Dame Chapter A.S.M. was an address on the evaluation of transformations in steel presented by A. R. Troiano, past chairman of the Notre Dame Chapter and currently professor of physical metallurgy at Case Institute of Technology.

As an introduction, Dr. Troiano discussed briefly the history of transformation studies and steel heat treatment, pointing out the fact that although steel treatment may have been looked upon previously as an art, it should now be recognized as a definite science.

There are five general transformations of interest, Dr. Troiano said, and described the salient features of each. They are:

1. Austenite to ferrite
2. Austenite to carbide
3. Austenite to pearlite
4. Austenite to martensite
5. Austenite to bainite

Of these five transformations, the bainite transformation is the least understood, Dr. Troiano pointed out. Bainite seems to have no definitive micro-characteristics which make it readily identifiable and X-ray methods give no satisfactory evidence.

Dr. Troiano presented slides which illustrated the S-curves of some familiar steels. An attempt is being made to classify *all* S-curves into a small number of groups (probably four), he said. A tentative method of classification was presented and evaluated in terms of a number of published transformation diagrams for commonly used steels. The classification is based upon the time-temperature-transformation relationships between the bainite and pearlite reactions.

A successful classification of the innumerable S-curves which appear for various steels will greatly further the refinement of steel treating into a science. In the ideal situation one should be able to predict the general type of S-curve which would be characteristic of a steel of known chemical composition.

Dr. Homerberg Retires From M.I.T. Faculty

Retirement of Victor O. Homerberg, professor of physical metallurgy, from the faculty of Massachusetts Institute of Technology has recently been announced, to take effect next July.

Dr. Homerberg is an authority on steels and other alloys of iron, and on the case hardening of steel in ammonia gas; he was one of the pioneers in the development and application of the nitriding process. Dr. Homerberg attended the Philadelphia College of Pharmacy and Science before entering M.I.T., from which he received his D.Sc degree. He began his teaching career while still a student, first in chemistry and then in metallography and metallurgy. He was advanced to the rank of professor in 1939.

Dr. Homerberg has written extensively for technical journals and has served as consulting metallurgist for numerous concerns. During the war he was active in cooperating with aircraft engine builders, and worked on metals suitable for tanks and other war materiel.

President Focke Helps to Honor Silver Jubilarians

Reported by F. R. Morral
Associate Professor, Syracuse University
Department of Materials Engineering

President Focke helped honor the Silver Jubilarians at the March 7th meeting of the Syracuse Chapter A.S.M. The ceremony was properly celebrated with a candle-lighted cake and with the president reminiscing about various activities with some of these early members.

The membership of the Crucible Steel Co. of America goes back to 1919, it was discovered. Members since 1920 include H. J. Stagg, Jr., F. G. Wheeler, and A. E. Thurber; since 1921, H. H. Mattison and C. T. Patterson; since 1922, R. L. Manier and M. E. Sutphen; and since 1923, S. B. Voorhees. Many of these early members were present to receive their 25-year certificates in person.

The occasion was also National Officers' Night, with Dr. Focke, national president, speaking on "The Metallurgist, the A.S.M. and Metal Industry" in his easy and friendly way.

Plans for the educational lectures to be sponsored jointly by the A.S.M. and Syracuse University were also presented at this meeting. A coffee talk by T. F. Dundon, of the Carrier Corp., outlined "Great Britain's Economic Picture", as viewed from trips made by the speaker during the past four years.

Students Have Open House

The University of Illinois College of Engineering threw open its doors for the Illinois Student Engineering Exhibit on March 10 and 11. This year's open house was the first since prewar years. Under the sponsorship of the Engineering Council, I SEE (as the exhibit is known) is designed primarily as an educational event to show the layman the organization of different branches of engineering.

The Mineral Industries Society, with the assistance of the department of mining and metallurgical engineering, planned displays of interest to the layman as well as those in the engineering profession.

Quality Control Improves Product, Reduces Costs

Reported by J. G. Cutton
Metallurgist
Carnegie-Illinois Steel Corp.

Quality control may be explained as a technique for analyzing statistics on operations, thus making possible the location of difficulties and their correction, thereby improving quality and reducing costs. This explanation served as an introduction to a talk on quality control at the Mahoning Valley Chapter's meeting on Feb. 14. Wade R. Weaver, director of quality control for Republic Steel Corp. and also vice-president of the American Quality Control Society, was the speaker.

As an example he cited the conversion from ingots to multiple cut length billet stock, in which a certain length of excess billet had to be scrapped from each ingot. By statistical control methods, it was found that the ingot weights were too heavy and weight variation from ingot to ingot was erratic. By obtaining control on ingot weights considerable steel was saved in the finished product. It took about one year of statistical work to correct the difficulties but when the job was finished a saving of $175,000 was realized over the previous methods.

Another example was the use of quality control to reduce gun failures in the last war. By reducing certain variables, rejections were minimized; likewise, confidence in our weapons was increased and the hazard of guns blowing up was minimized.

In the rolling of a particular grade of steel a study was made to determine what caused poor surface quality. Fourteen separate factors were believed to influence the surface of the steel. A correlation analysis brought out that actually only five factors were important. When these five factors were all in control, good surface quality resulted.

Quality control, continued Mr. Weaver, indicates trends and directions, and data should be accumulated long enough so that a positive difference is indicated. Guesswork and opinion are eliminated and facts are disclosed. Many problems which now have no apparent solution can be solved by mathematical control. With this relatively new tool for industry, answers are obtained which have never before been possible.

Salt Bath Brazing Offers Advantages

Reported by Arthur C. Willis
Instructor
Southern Methodist University

Brazing by the salt bath method offers a number of advantages, A. F. Holden, president of A. F. Holden Co., told the North Texas Chapter A.S.M., on Feb. 15 in Fort Worth.

Salt bath brazing provides uniform heating of the assembly, he pointed out, thus minimizing the voids found in brazed joints. Furthermore, a neutral salt bath may be used for heat treating, in addition to brazing. Decarburization is no problem in a salt bath. Finally, no special flux is required, and excess flux is automatically removed during the brazing operation.

Mr. Holden stated a fundamental principle applicable to all types of brazing—namely, that the heating process cannot be interrupted (except at a temperature low enough simply to dry the flux), or the joint will not be good. Furthermore, the joint must be well fluxed, or bonding will not be satisfactory.

With silver brazing, close clearances are required for a good joint, and a temperature 100 to 200° above the melting point is considered desirable.

With brass or bronze, the bath is maintained at approximately 1800° F. This permits of combining the heat treating of steel with the brazing operation, if this be desired, since the piece can be quenched or simply placed in a salt bath of lower temperature. The time of holding at 1800° is too short for undesirable grain growth.

Copper brazing is carried on at the highest temperature, and produces the strongest joint and best penetration. It requires no flux.

Placing of the brazing alloy in position is less important than good fluxing, Mr. Holden stressed. As with any process, brazing must be justified economically. It must be cheaper than other methods of fastening, or better, or both.

During a lively question period following the talk, several points were settled. Entrapment of flux is no problem in salt bath brazing, it was learned; there is no explosion hazard if the flux has been dried after application; and the fluxes do not contaminate a neutral salt bath, usually floating to the surface without reacting.

Becomes Casting Consultant

John B. Caine, a past chairman of the Cincinnati Chapter A.S.M., has resigned as director of research for Sawbrook Steel Castings Co., Lockland, Ohio, and is now in business for himself as technical consultant on casting problems.

IMPORTANT MEETINGS FOR MAY

May 3-4—21st Annual Welding Conference and Welders Institute and Exhibition, Purdue University, Lafayette, Ind. (Welding Conference, Technical Extension Division, Purdue University, Lafayette, Ind.)

May 18-19—American Zinc Institute. Spring Meeting of the Galvanizers Committee, King Edward Hotel, Toronto, Canada. (E. V. Gent, secretary, A. Z. I., 60 East 42nd St., New York 17.)

May 25-27—Society for Experimental Stress Analysis. Spring Meeting, Hotel Statler, Cleveland. (S.E.S.A., P. O. Box 168, Cambridge 39, Mass.)

May 26-27—Society for Applied Spectroscopy. Fifth Annual Meeting, Socony-Vacuum Training Center, New York City. (Rodger W. Loofbourow, Merck & Co., Inc., Chemical Control Division, Rahway, N. J.)

May 28-31—American Institute of Chemical Engineers. Regional Meeting, New Ocean House, Swampscott, Mass. (F. J. Van Antwerpen, A.I.C.E., 120 East 42nd St., New York 17.)

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Hardenability Story Had Beginnings In Many Sources

Reported by H. L. Sittler
Metallurgist, Arcrods Corp.

"The Hardenability Story" was recounted by John M. Hodge before the Baltimore Chapter A.S.M. on Jan. 16. It is an unfinished story and yet many of its vagaries can be anticipated and prevented or at least controlled, said the speaker, a research associate at Carnegie-Illinois Steel Corp.

If we compare the life of hardenability to a human life, the former seems to have passed through boyhood and is now in the period of its youth. While the parentage of hardenability may be obscure and indeterminate—it probably was born when some butter-fingered blacksmith dropped a red-hot bar into a bucket of water—it does not lack for foster parents. Shepherd, French, Grossmann, Bain, Mehl, Jominy, and Boegehold are only a few of those who contributed so generously to the unfolding of the hardenability story.

Perhaps the first scientific and fundamental work on the physical aspects of hardenability was Shepherd's development of the P-F test and fracture grain size test. French's work was also basic to fundamental data; determinations of cooling rate, the "surface to volume" concept, and effect of circulation of coolant were prime factors. The S.A.C. curves originated by Archer et al point up a fundamental property of steel. The wide acceptance and use of Jominy and Boegehold's end-quench tests are indicative of its service to hardenability measurement and control. Grossmann's critical diameter cylinder which led to the concept and development of "H" values, and the half-temperature time curves developed by Grossmann and co-workers, are no less fundamental.

Among the first proponents of the microstructural aspect of hardenability were Bain and Davenport. Their mechanism of microstructural control and their demonstration of the superior properties of tempered martensite as compared to pearlitic structures are now classical. From such concepts as these, the NE steels were developed and successfully applied, solely on the basis of hardenability, regardless of alloy content.

The further development of H-steels and H-bands was given great impetus by this microstructural aspect of hardenability. The most commonly used microstructural criterion has been 50% martensite, but microstructures containing higher percentages of martensite are more representative of the desired superior properties of tempered martensite. Microstructures of 90 to 95% martensite, therefore, have certain advantages as criteria of hardenability.

Grossmann's work in which he was able to predict fairly accurately the hardenability from the chemical analysis (including residual elements) was a great step forward. Each element has its own multiplying factor correlating the amount present with the ultimate hardness developed in the presence of other influencing elements.

The effect of each element is the same, however, no matter whether the hardenability criterion is 50% martensite, 95% martensite or 100% martensite. It is necessary for each element to be completely in solution in the austenite as well as for all carbide to be in solution if the maximum hardenability is to be obtained.

A lively question-and-answer period, which had to be stopped by the technical chairman, followed Mr. Hodge's talk.

Army Investigation of Transverse Properties Yields Basic Data

Reported by S. A. Minton, Jr.
Allison Division, G.M.C.

"Get as many specimens as are needed to insure desired accuracy, and utilize all the information derived from testing these specimens," advised Cyril Wells in his talk on "Transverse Properties of Steels" before the Indianapolis Chapter A.S.M. on Jan. 16.

His remarks were confined to wrought steels, quenched to essentially 100% martensite and tempered to a given hardness. Most of the testing was confined to gun tubes in an effort to supply basic information for use in changing Army specifications on transverse mechanical properties. Steels within the ranges of 0.3 to 0.45% carbon and 1.5 to 4.5% alloy were investigated, since little scientific information was available on the transverse properties of these types.

Poor transverse properties, per se, may not cause failure, Dr. Wells said, but may be an indication that other properties of the steel may be low or that undesirable stringers, flakes, or other defects may be present.

The subject was attacked from a statistical quality control viewpoint, using transverse per cent reduction of area as a measure of transverse ductility. In the longitudinal direction, only a few specimens are required to give a true picture of properties, because the spread in properties is relatively narrow. Since the average reduction in area drops off and the spread between maximum and minimum values increases as the angle between longitudinal axis of specimens and fiber direction increases from 0 to 90°, a larger number of specimens is required to investigate the transverse properties.

This variation is larger in high-quality forgings than might be expected—usually 30%. Forgings normally considered of good quality rarely vary by less than 18%, and may vary by as much as 40%, in transverse reduction of area.

Several conclusions were drawn from these investigations:

1. Better transverse per cent reduction of area is obtained from an essentially 100% martensitic quench than from a quench resulting in a partly bainitic structure.
2. Re-heat treatment of fully quenched and tempered forgings does not improve transverse ductility.
3. The standard deviation in transverse per cent reduction of area is usually about 4% and does not vary significantly with yield strength.
4. The distribution is approximately normal.
5. All forgings from the same heat are usually essentially alike.
6. An increase of 10,000 psi. in yield strength is accompanied by a drop of about 3% in transverse per cent reduction of area.
7. Samples from the end of a forging are generally indicative of the quality of the rest of the forging.

Four important results could be credited to this investigation: *(a)* sounder Army specifications of transverse properties, *(b)* a better utilization of equipment, *(c)* a more efficient inspection of material, and *(d)* a considerable saving in dollars.

Traces Troubles Met in Toolsteel Heat Treatment

Reported by Sigmund L. Smith
Colorado School of Mines

Instances in which a toolsteel of known characteristics does not respond normally to heat treatment formed the main concern of a slide-illustrated talk by George Schad of the metallurgical department, Carpenter Steel Co. Mr. Schad addressed the Rocky Mountain Chapter A.S.M., meeting on Jan. 20 in Denver, on "Toolsteel Problems".

Heat treating difficulties may vary anywhere from slightly low hardnesses to severe cracking in quenching, the speaker said. Some of the causes for these troubles may be failure to remove decarburized bar surface before heat treatment, effect of overheating or nonuniform heating, damage to the surface caused by carburization or decarburization during hardening, and effects of careless quenching in both water and oil.

In addition to the purely metallurgical aspects of heat treating procedures, the danger of damage in finish grinding was also discussed. Trouble may occur even with ideal grinding practice if tools have been abused in heat treatment, Mr. Schad pointed out.

NATIONAL METAL CONGRESS & EXPOSITION

Chicago International Amphitheatre • October 23 *to* 27, 1950

Competition for Students at the 1950 Metallographic Exhibit

THE DETAILS ▸ Undergraduates can now compete on an equal basis at the metallographic exhibit held each year at the National Metal Congress and Exposition without limitations as to subject matter or techniques. Separate panels will be erected for adequate display of their best work. Excellence will be judged by the same jury that appraises the work of professionals. Prizes will be awarded as follows:

First Prize—Bronze Medal and $25 cash.
Honorable Mentions—Ribbon and $10 cash.

THE RULES ▸ Entrants are restricted to undergraduate students of academic institutions. ¶ No more than two entries will be accepted from a single student. ¶ Work must be done during the 1949-1950 academic year. ¶ Entries must be mounted separately on stiff cardboard. ¶ Each mount must contain pertinent information regarding subject, etchant, magnification, and special techniques (if any). ¶ Entrant must sign mount and give name of institution, course being studied, and year of graduation. ¶ Mount must be signed by departmental head, as evidence that the above conditions are met.

Send Entries (BEFORE JUNE 1, 1950) to

METALLOGRAPHIC EXHIBIT—*Student Division*

7301 Euclid Avenue • Cleveland 3, Ohio

A. S. M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received During the Past Month

Prepared in the Library of Battelle Memorial Institute, Columbus, Ohio
W. W. Howell, Technical Abstractor
Assisted by Pauline Curry, N. W. Baklanoff, Fred Rothfuss, and Leila M. Virtue

A GENERAL METALLURGICAL

67-A. Iron Ore. A. L. Fairley, Jr. *Mining Congress Journal*, v. 36, Feb. 1950, p. 59-63.
1949 economic developments. (A4, Fe)

68-A. Copper. Wide Fluctuations in Demand Experienced in 1949. E. O. Sowerwine. *Mining Congress Journal*, v. 36, Feb. 1950, p. 89-91, 96.
Economic developments of 1949. (A4, Cu)

69-A. Lead in '49. Charles R. Ince. *Mining Congress Journal*, v. 36, Feb. 1950, p. 92-93.
Economic developments. (A4, Pb)

70-A. Zinc in 1949. W. G. Woolf. *Mining Congress Journal*, v. 36, Feb. 1950, p. 94-95.
Economic developments. (A4, Zn)

71-A. The Strategic Metals Industry. *Mining Congress Journal*, v. 36, Feb. 1950, p. 107.
Domestic-production situation for Cr, Hg, Sb, W, and Mn. In each case, production has practically ceased, as a result of governmental actions. (A4, Cr, Hg, Sb, W, Mn)

72-A. Light Metals. Richard H. Mote and Horace F. Kurtz. *Mining Congress Journal*, v. 36, Feb. 1950, p. 111-113, 115.
1949 economic developments in Al, Mg, and Ti. (A4, Al, Mg, Ti)

73-A. Ferro-Alloys in 1949. Edwin K. Jenckes. *Mining Congress Journal*, v. 36, Feb. 1950, p. 116-118.
Surveys U. S. and foreign production of Cr, Mo, W, Mn, V, Ti, Co, Ni, Cb, and Ta. (A4, Fe-n)

74-A. Scrap Metals. Charles White Merrill, Norwood B. Melcher and Archie J. McDermid. *Mining Congress Journal*, v. 36, Feb. 1950, p. 123-124.
1949 production, prices, recovery, and consumption of ferrous and nonferrous scrap. (A8, A4)

75-A. Steel Mill Purifies Waste Water. William Czygan. *Iron Age*, v. 165, Feb. 23, 1950, p. 82-84.
New installation of Alan Wood Steel Co. (A8, ST)

76-A. Lead Output in 1949 Highest Since 1944. *Skillings' Mining Review*, v. 38, Feb. 25, 1950, p. 1.
Brief statistical survey of U.S. production. (A4, Pb)

77-A. Acid Iron Wastes Neutralization. Richard D. Hoak. *Sewage and Industrial Wastes*, v. 22, Feb. 1950, p. 212-221.
Various methods, neutralization agents, and equipment for neutralization of spent pickle liquor. (A8)

78-A. An Acid Iron Wastes Neutralization Plant. Rov F. Lab. *Sewage and Industrial Wastes*, v. 22, Feb. 1950, p. 222-223.
Plant of Copperweld Steel Co., Warren, Ohio. (A8)

79-A. Acid Wastes Treatment. Edward M. Jones. *Sewage and Industrial Wastes*, v. 22, Feb. 1950, p. 224-227.
Acid waste-treatment activities selected from some experiences of the Tennessee Copper Co. The wastes have their origin in the operations associated with the large-scale manufacture of H_2SO_4 from heavy sulfide ores. (A8, Cu)

80-A. Treatment of Cyanide Wastes From the Electroplating Industry. Arthur N. Corcoran. *Sewage and Industrial Wastes*, v. 22, Feb. 1950, p. 228-238.
Various methods derived from a variety of metallurgical operations. 20 ref. (A8)

81-A. The Utilization of Raw Material in the Ferrous Metallurgical Industry in the Union of South Africa. T. J. W. Jorden. *Engineering & Chemical Digest*, v. 2, Jan. 1950, p. 15-21.
Economic and technological trends, with particular reference to steelmaking. Includes production data. (A4, D general, Fe)

82-A. Range Production From Raw Material to Shipping Dock. Gerald Eldridge Stedman. *Finish*, v. 7, Mar. 1950, p. 33-38, 40-42, 69-71.
Tooling, fabrication, metal preparation, finishing, assembly, and packaging and shipping practices at A. J. Lindemann & Hoverson Co., Milwaukee. (A5, T10)

83-A. The Disposal of Spent Acid Pickling Liquor. II. Vacuum Evaporation. W. B. Wragge. *Wire Industry*, v. 17, Feb. 1950, p. 121, 124-126.
Equipment and procedures. 18 ref. (A8)

84-A. The Silver Situation. Pat McCarran. *Mining Congress Journal*, v. 36, Feb. 1950, p. 108-110.
Statistical data. The present economic situation and future prospects. (A4, Ag)

85-A. Waste-Disposal Studies by the American Electroplater's Society. C. Fred Gurnham. "Proceedings of the Fourth Industrial Waste Conference", *Purdue University*, Extension Series No. 68; *Engineering Bulletin*, v. 33, July 1949, p. 238-243.
Research program; accomplishments to date and plans for the future. (A8)

86-A. Methods of Disposing of Cyanide Wastes. R. L. Kessler and R. W. Oyler. "Proceedings of the Fourth Industrial Waste Conference", *Purdue University*, Extension Series No. 68; *Engineering Bulletin*, v. 33, July 1949, p. 244-249.
Program developed and used at General Motors' Delco-Remy Div. (A8)

87-A. Disposal of Waste Cyanides by Electrolytic Oxidation. R. W. Oyler. "Proceedings of the Fourth Industrial Waste Conference", *Purdue University*, Extension Series No. 68; *Engineering Bulletin*, v. 33, July 1949, p. 250-254.
Procedure used at the Guide Lamp Div., General Motors Corp. (A8)

88-A. Value of Canada's Mineral Production Reaches $890 Millions. H. McLeod. *Canadian Mining Journal*, v. 71, Feb. 1950, p. 62-71.
A statistical survey. (A4)

89-A. British Columbia in 1949. Fred H. Stephens. *Canadian Mining Journal*, v. 71, Feb. 1950, p. 72-80.
Statistical data on production of various minerals. (A4)

90-A. Review of Mineral Production: Saskatchewan. W. James Bichan. *Canadian Mining Journal*, v. 71, Feb. 1950, p. 90-92.
Statistical data. (A4)

91-A. Mining in Manitoba in 1949. J. P. de Wet. *Canadian Mining Journal*, v. 71, Feb. 1950, p. 93-97.
Statistical data on production of various minerals. (A4)

92-A. Ontario Annual Review. J. C. Browning. *Canadian Mining Journal*, v. 71, Feb. 1950, p. 98-105.
Surveys production of various minerals. (A4)

93-A. Quebec Annual Review. J. C. Browning. *Canadian Mining Journal*, v. 71, Feb. 1950, p. 106-112.
Surveys production of various minerals. (A4)

94-A. Treatment of Crude Phosphate in Molten Blast-Furnace Slag. (In German.) Wilhelm Wolf. *Stahl und Eisen*, v. 70, Jan. 5, 1950, p. 24-26.
An attempt was made to treat crude phosphate with molten slag and thus to convert the $Ca_3(PO_4)_2$ into a form soluble in soil acid. Successful results were obtained by blowing ground phosphate into a ladle filled with slag. (A8, Fe)

95-A. Recommendations on the Economic Utilization of Blast-Furnace Slag. (In German.) K. Peukert. *Metall*, v. 4, Feb. 1950, p. 55-57.
Estimates on the cost of extracting the metal contained in slags, the production of pigment oxides, and the conversion of slag into cement. (A8)

96-A. The Unit Processes of Chemical Metallurgy. R. Schuhmann, Jr. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Extractive Metallurgy Division), v. 182, 1949, p. 321-326; discussion, p. 326.
Previously abstracted from *Metals Technology*. See item 25a-42, 1948. (A3)

97-A. Review of Iron and Steel Literature for 1949. Morris Schrero. *Blast Furnace and Steel Plant*, v. 38, Mar. 1950, p. 341-342, 344-345, 350-352, 367, 378-379.
33rd annual review. (A10)

98-A. Production Line Methods Speed Output of Heavy Equipment. *Steel*, v. 126, Mar. 20, 1950, p. 82.
Equipment of Euclid Road Machin-

ery Co. includes drill, shears, press brakes, and weld jigs. (A5, T4)

99-A. Long-Term Demand Will Force Metal Prices Up. William P. Shea. *Engineering and Mining Journal*, v. 151, Mar. 1950, p. 81-83.
World-wide economic analysis and forecast, backed by statistics. (A4)

100-A. Stream Pollution and the Plating Industry. C. Fred Gurnham. *Products Finishing*, v. 14, Mar. 1950, p. 26-28, 30, 32, 34, 36, 38, 40.
Economic, legal, and technological factors. (A8, L17)

101-A. Discussion on the Disposal of Plating Shop Effluents. *Journal of the Electrodepositors' Technical Society*, v. 25, 1950, p. 17-22. (Preprint.)
Discusses paper by A. E. J. Pettet. See item 52-A, 1950. (A8, L17)

102-A. Laboratories of the British Non-Ferrous Metals Research Association. *Engineering*, v. 169, Feb. 17, 1950, p. 179-180, 182.
(A9, EG-a)

103-A. (Book) **Seventh Semiannual Report of the Atomic Energy Commission.** 228 pages. Jan. 1950. U. S. Atomic Energy Commission, Washington, D. C.
Activities and developments during 1949 in production, military applications, reactor development, biology, medicine, finance, defense planning, education, organization, personnel, and security. Research in physical sciences and progress in atomic energy covering objectives, activities, application of results, management, and laboratories. (A general)

104-A. (Book) **Manufacturing Processes.** S. E. Rusinoff. 393 pages. 1949. American Technical Society, Drevel Ave. at 58th St., Chicago.
Materials, processes, and equipment. Covers sand molding, production of sand castings, other casting processes, hot and cold forming, joining processes, heat treatment, powder metallurgy, plastics, and plastic molding.
(A5, E general, F general, G general, H general, J general, K general)

105-A. (Book) **The Physico-Chemical Principles of Metallurgy.** (In German.) W. Baukloh. 300 pages. 1949. Akademie-Verlag, Berlin, Germany. 20 marks.
Scans almost the whole of metallurgical knowledge and manages to build quite heterogeneous and seemingly unrelated subjects into one well-integrated picture. Theoretical principles are given first place, but examples of the direct practical application of the principle in question are always provided. Atomic theory is dealt with only rather superficially. (From review in *Metal Treatment and Drop Forging.*) (A general)

B

RAW MATERIALS AND ORE PREPARATION

51-B. Atomic Energy and the Mining Industry. *Mining Congress Journal*, v. 36, Feb. 1950, p. 30-33.
Recent developments in prospecting, mining, geology, and treatment of uranium ores. (B12, B10, U)

52-B. A Perspective of Milling Operations. Nathaniel Herz. *Mining Congress Journal*, v. 36, Feb. 1950, p. 44-46, 50.
1949 developments and future prospects. Crushing and grinding, screening and classification, gravity concentration, and flotation. (B13, B14)

53-B. The Cerro Bolivar-Altamira-Arimagua Iron Range: U. S. Steel's Answer to the Iron Ore Shortage. Tom C. Campbell. *Iron Age*, v. 165, Mar. 2, 1950, p. 75-80.
U. S. Steel's strategic iron-ore find in Venezuela. (B10, Fe)

54-B. The Chemistry of Metallurgical Slags. *Industrial Heating*, v. 17, Feb. 1950, p. 262.
Previously abstracted from paper by N. J. Grant and John Chipman, *American Iron and Steel Institute*, Preprint, 1949. See item 2B-152, 1949. (B21, ST)

55-B. Refractories: Types, Properties and Service Behavior. R. P. Heuer and C. E. Grigsby. *Steel*, v. 126, Mar. 6, 1950, p. 86-90, 110, 112, 114, 117; Mar. 13, 1950, p. 94-98, 124.
First article: Types and forms of available refractories, and their major characteristics and service behavior. Second article: Silica, basic, and special refractories. (B19)

56-B. Mining Geology and Exploration. Rodgers Peale. *Mining Congress Journal*, v. 36, Feb. 1950, p. 77-81, 88.
Recent discoveries in the U. S. and abroad. (B10)

57-B. Investigation of Cherry Creek Tungsten District, White Pine County, Nev. George H. Holmes, Jr. *U. S. Bureau of Mines*, Report of Investigations 4631, Feb. 1950, 7 pages.
Physical features and mineral deposits. Mining and milling practices. (B10, B12, B13, W)

58-B. Investigation of the Beecher No. 2 Lithium-Bearing Pegmatite, Custer County, S. Dak. John Paul Gries. *U. S. Bureau of Mines*, Report of Investigations 4632, Feb. 1950, 14 pages.
Beneficiation tests on a composite sample of spodumine-bearing pegmatite containing 2.18% lithia. (B10, B14, Li)

59-B. Investigation of the Zebulon or Privett Manganese Deposit, Wake County, N. C. Thomas W. Thompson. *U. S. Bureau of Mines*, Report of Investigations 4633, Feb. 1950, 15 pages.
Magnetic separation and flotation tests on several samples.
(B10, B14, Mn)

60-B. Economic Importance of Pegmatites. Paul M. Tyler. *U. S. Bureau of Mines*, Information Circular 7550, Feb. 1950, 57 pages.
Pegmatites consist principally of potash, feldspar, and quartz, usually mica, and sometimes rare minerals. Location, geology, structure, mining and milling methods and their cost, and general economic considerations. 91 ref. (B10, B12, B13, A4, EG-b)

61-B. Fundamental Principles of Mechanical Size Reduction. II. Physical Processes in Grinding Plants. (In German.) E. Podszus. *Archiv für Metallkunde*, v. 3, Dec. 1949, p. 414-422.
Analysis of the operation of different mills shows that a high degree of efficiency requires a rapid succession of impacts and the elimination of "dead" zones and of predominant flow directions. 14 ref. (B13)

62-B. Zinc and Iron. (In German.) A. Kutzelnigg. *Archiv für Metallkunde*, v. 3, Dec. 1949, p. 438-440.
Effect of impurities on the reducibility and properties of zinc and iron ores and the biological role of these two metals in the plant and animal world. The metallurgical and biological interaction between Zn and Fe. 21 ref. (B10, Zn, Fe)

63-B. Symposium on Milling Devices and Practices. J. F. Myers and R. J. Tower. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 11-25; discussion, p. 25.
Previously abstracted from *Mining Technology*. See item 1-71, 1947. (B13)

64-B. Milling Lead-Zinc Ores at Iron King Mine, Prescott, Arizona. H. R. Hendricks. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 26-30.
Previously abstracted from *Mining Technology*. See item 1-120, 1947. (B13, Pb, Zn)

65-B. Milling Practice at New Lead-Zinc Concentrator of Phelps Dodge Corporation. R. C. Thompson. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 31-40.
Previously abstracted from *Mining Technology*. See item 1-119, 1947. (B13, Pb, Zn)

66-B. Milling Practices at Concentrator of Morenci Reduction Works. B. H. Cody. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 41-66.
Previously abstracted from *Mining Technology*. See item 1-117, 1947. (B13, Cu)

67-B. Mufulira Copper Mines Limited, Concentrator, Northern Rhodesia. Jack White and Ralph B. Adair. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 67-75; discussion, p. 76-78.
Previously abstracted from *Mining Technology*. See item 1c-17, 1948. (B14, Cu)

68-B. Description of Concentrating Operations, Roan Antelope Copper Mines Limited, Northern Rhodesia. M. R. Goldick. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 79-94.
Previously abstracted from *Mining Technology*. See item 1c-18, 1948. (B14, Cu)

69-B. Milling Practice at Idarado Mining Company. F. W. McQuiston, Jr. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 95-100.
Previously abstracted from *Mining Technology*. See item 1c-42, 1948. (B13, B14, Ag, Au, Cu, Pb, Zn)

70-B. Metallurgy at National Lead Company, MacIntyre Development. Frank R. Milliken. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 101-114; discussion, p. 114-115.
Previously abstracted from *Mining Technology*. See item 1c-43, 1948. (B14, Pb)

71-B. Tailings and Mine-Dump Reclamation in the Coeur d'Alenes During World War II. W. L. Zeigler. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 116-125.
Previously abstracted from *Mining Technology*. See item 1-47, 1947. (B14, Ag, Pb, Zn)

72-B. The Application of Xanthates to Flotation. Norman Weiss. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 145-156.
Previously abstracted from *Mining Technology*. See item 1-132, 1947. (B14)

73-B. Effect of "Metso" (Sodium Meta-Silicate) on Mill Recoveries of Alta-St. Louis Ores. Henry P. Ehrlinger. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 157-159.
Previously abstracted from *Mining Technology*. See item 1-158, 1947. (B13, Ag, Au, Cu, Pb, Zn)

74-B. Effects of Oxidation of Sulphide Minerals on Their Flotation Properties. Enid C. Plante and K. L. Sutherland. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 160-188.

Previously abstracted from *Mining Technology*. See item 1a-4, 1948. (B14)

75-B. Flotation of Unoxidized and Oxidized Sulphide Minerals—Antimonite, Arsenopyrite, Covellite, Lollingite, Marcasite, Orpiment, Pyrrhotite and Tetrahedrite. Enid C. Plante. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 189-203.

Previously abstracted from *Mining Technology*. See item 1a-5, 1948. (B14, Sb, Fe, Cu)

76-B. Attachment of Mineral Particles to Air Bubbles in Flotation. H. Rush Spedden and William S. Hannan, Jr. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 208-213.

Previously abstracted from *Mining Technology*. See item 1a-14, 1948. (B14)

77-B. Flotation of Low Grade Gold Ores at Golden Cycle Corporation. Howard R. Keil. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 214-218.

Previously abstracted from *Mining Technology*. See item 1c-44, 1948. (B14, Au)

78-B. Simultaneous Grinding and Flotation. A. Kenneth Schellinger and O. Cutler Shepard. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 219-224. (B13, B14, Pb, Zn, Cu)

79-B. Notes on Drying for Electrostatic Separation of Particles. Foster Fraas. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 225-238; discussion, p. 238-239.

Previously abstracted from *Mining Technology*. See item 1-157, 1947. (B14)

80-B. The Electrostatic Separation of Several Industrial Minerals. Foster Fraas and Oliver C. Ralston. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 240-250; discussion, p. 250-251.

Previously abstracted from *Mining Technology*. See item 1a-26, 1948. (B14)

81-B. Comparison of Galena and Ferrosilicon in Heavy-Media Separation. E. H. Crabtree, Jr. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 252-256.

Previously abstracted from *Mining Technology*. See item 1-72, 1947. (B14, Pb, Zn)

82-B. A New Separating Vessel for Sink-Float Concentration. E. C. Bitzer. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 257-275; discussion, p. 275.

Previously abstracted from *Mining Technology*. See item 1-73, 1947. (B14)

83-B. Metallurgical Efficiency—A Yardstick in Lead-Zinc Flotation Metallurgy. R. A. Pallanch. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 283-287; discussion, p. 287-288.

Previously abstracted from *Mining Technology*. See item 1-45, 1947. (B14, Pb, Zn)

84-B. A Short-Cut Method of Metallurgical Accounting. E. H. Crabtree, Jr. and Neil S. Parker. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 289-291.

Previously abstracted from *Mining Technology*. See item 1-118, 1947. (B13)

85-B. Crushing Practice at the Braden Copper Company. E. R. Johnson. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 292-298.

Previously abstracted from *Mining Technology*. See item 1-46, 1947. (B13, Cu)

86-B. Rod Milling—Plant and Laboratory Data. J. F. Myers, S. D. Michaelson, and F. C. Bond. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 299-311; discussion, p. 311-312.

Previously abstracted from *Mining Technology*. See item 1-122, 1947. (B13, Cu, Pb)

87-B. Standard Grindability Tests Tabulated. Fred C. Bond. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 313-329.

Previously abstracted from *Mining Technology*. See item 1-121, 1947. (B13)

88-B. Wet Grinding of Ferrosilicon for Heavy Media. E. H. Crabtree and T. C. King. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 361-366.

Previously abstracted from *Mining Technology*. See item 1c-34, 1948. (B13, Fe, Si)

89-B. The Combination Process for Alumina. J. D. Edwards. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Extractive Metallurgy Division), v. 182, 1949, p. 9-13.

Previously abstracted from *Metals Technology*. See item 1-17, 1945. (B14, Al)

90-B. Alumina From Clay by the Lime-Sinter Method. II. F. R. Archibald and C. M. Nicholson. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Extractive Metallurgy Division), v. 182, 1949, p. 14-38.

Previously abstracted from *Metals Technology*. See item 2d-15, 1948. (B16, Al)

91-B. The Ammonium Sulphate Process for the Extraction of Alumina From Clay and Its Application in a Plant at Salem, Oregon. W. R. Seyfried. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Extractive Metallurgy Division), v. 182, 1949, p. 39-50.

Previously abstracted from *Metals Technology*. See item 1D-1, 1949. (B14, Al)

92-B. The Plant of the Dow Magnesium Corporation at Velasco, Texas. C. M. Shigley. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Extractive Metallurgy Division), v. 182, 1949, p. 59-67.

Previously abstracted from *Metals Technology*. See item 2-54, 1945. (B14, C23, Mg)

93-B. The Refractory or "Fireless Cooker" Method of Producing Magnesium. E. G. De Coriolis. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Extractive Metallurgy Division), v. 182, 1949, p. 93-112.

Previously abstracted from *Metals Technology*. See item 2-16, 1946. (B15, Mg)

94-B. Magnesium From Olivine. E. C. Houston. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Extractive Metallurgy Division), v. 182, 1949, p. 113-126.

Previously abstracted from *Metals Technology*. See item 2-52, 1945. (B14, Mg)

95-B. The Oxidation of Chalcocite in Air Compared With Its Oxidation in Pure Oxygen. J. R. Lewis, J. H. Hamilton, J. C. Nixon, and C. L. Graverson. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Extractive Metallurgy Division), v. 182, 1949, p. 177-185.

Previously abstracted from *Metals Technology*. See item 2C-36, 1948. (B15, Cu)

96-B. The Dithionate Process for Recovery of Manganese From Low-Grade Ores. S. F. Ravitz, W. Wyman, A. E. Back, and K. E. Tame. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Extractive Metallurgy Division), v. 182, 1949, p. 286-295.

Previously abstracted from *Metals Technology*. See item 1-55, 1946. (B14, Mn)

97-B. Concurrent Firing at the Sulphur Bank and Reed Quicksilver Plants. R. G. Hall and W. Bradley. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Extractive Metallurgy Division), v. 182, 1949, p. 296-306.

Previously abstracted from *Metals Technology*. See item 1-4, 1946. (B15, Hg)

98-B. Treatment of Idaho-Wyoming Vanadiferous Shales. S. F. Ravitz, I. W. Nicholson, C. J. Chindgren, L. C. Bauerle, F. P. Williams, and M. T. Martinson. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Extractive Metallurgy Division), v. 182, 1949, p. 307-320.

Previously abstracted from *Metals Technology*. See item 1-74, 1947. (B14, B15, V)

99-B. Operating Practices at the Portsmouth Sinter Plant. Guy B. Hunner. *Journal of Metals*, v. 188, Mar. 1950, p. 471-473.

The Portsmouth sintering operations in the Lake Superior iron ore district. Changes effected to increase daily production from 1123 to 1658 tons. (B16, Fe)

100-B. Iron Ore for Great Britain. H. U. Ross. *Mine & Quarry Engineering*, v. 16, Mar. 1950, p. 80-84.

Emphasis on the new Quebec-Labrador Range. (B10, Fe)

101-B. Today's Iron Ore Sources and Our Future Supply. *Engineering and Mining Journal*, v. 151, Mar. 1950, p. 70-71.

Chart shows the principal sources from which the 10 leading steel companies of the U. S. obtain their iron ore. Prospective future sources. (B10, Fe)

102-B. Low-Cost Production of Zinc Dust From Oxidized Ores. Harry J. Morgan. *Engineering and Mining Journal*, v. 151, Mar. 1950, p. 72-75.

Seven steps in proposed process are calcination at 250-400° C., solution in strong caustic, separation by decantation or filtration, removal of Pb by precipitation, precipitation of Zn sponge, washing and drying Zn dust, and regeneration of spent solution. Experimental work; and alternative methods. (B15, Zn)

103-B. Fluo Solids for Roasting. T. B. Counselman. *Engineering and Mining Journal*, v. 151, Mar. 1950, p. 84-85.

Use of suspended or fluidized solids technique. Developments point toward better control, improved product, and lower cost for roasting or drying sul-

fides and iron ores. Diagrams show a lime kiln and an ore roaster based on this principle. (B15)

104-B. Exploration to Replenish World Mineral Reserves. Walter Hull Aldridge. *Mining Engineering,* v. 187, Mar. 1950, p. 349-350.

Believes that necessary ores for the foreseeable future will be located. (B10)

105-B. Radiotracer Studies on the Interaction of Dithiophosphate With Galena. G. L. Simard, J. Chupak, and D. J. Salley. *Mining Engineering; Transactions of the American Institute of Mining and Metallurgical Engineers,* v. 187, Mar. 1950, p. 359-364.

The above interaction was shown to have characteristics of both chemisorption and chemical reaction. Sorption was rapid and markedly reversible, and flotation occurred with relatively small amounts of sorbed dithiophosphate. 12 ref. (B14, S19, Pb)

106-B. Experiences With a Density Recording and Controlling Instrument for Heavy-Media Separation Units. James J. Bean. *Mining Engineering; Transactions of the American Institute of Mining and Metallurgical Engineers,* v. 187, Mar. 1950, p. 365-368.

The two installations described employ the usual method of measurement. Pneumatic control with band control and reset features is used to regulate dilution water and hence specific gravity. Difficulties have been mechanical in nature. (B14)

107-B. Behavior of Mineral Particles in Electrostatic Separation. Shiou-Chuan Sun, J. D. Morgan, Jr., and R. F. Wesner. *Mining Engineering; Transactions of the American Institute of Mining and Metallurgical Engineers,* v. 187, Mar. 1950, p. 369-373.

New apparatus termed a "distribution analyzer" for ascertaining optimum conditions of electrostatic separation. 20 ref. (B14)

108-B. Production of Ammonium Sulphate and Manganese Oxides. Norman Ketzlach. *Mining Engineering; Transactions of the American Institute of Mining and Metallurgical Engineers,* v. 187, Mar. 1950, p. 391-394.

Chemical process for recovery of high-grade Mn oxides from low-grade Mn ores. Ammonium sulphate is also produced. Mn ore is leached with H_2SO_3-H_2SO_4 acids. Impurities are removed with NH_3, heat, and air. Mn oxides are produced by addition of more NH_3 and air under pressure. $(NH_4)_2SO_4$ is recovered from the remaining solution. (B14, Mn)

109-B. Relationship of Chemisorptive Activity of Minerals to Their Flotation Properties. (In Russian.) V. A. Glembotskii. *Izvestiya Akademii Nauk SSSR* (Bulletin of the Academy of Sciences of the USSR), Section of Technical Sciences, Nov. 1949, p. 1701-1709.

Investigated on the basis of contemporary concepts of heterogeneous catalysis. An attempt was made to establish a relation between chemisorptive activity and particle size. Shows that change of rate of flotation under given conditions characterizes the difference in activity of different particles of the same material. 19 ref. (B14)

110-B. Probable Indices of Separation of Solids. (In Russian.) Z. V. Volkova. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, Dec. 1949, p. 1231-1236.

A new method for calculation of the degree of extraction of heterogeneous solids imbedded in a solid matrix (such as rock, ore, etc.) for a given degree of grinding. Formulas derived. (B13)

111-B. Aspects of Commercial Monazite Ore Dressing. (In Portuguese.) Paulo Krumholz. *Boletim da Associaçao Brasileira de Metais,* v. 5, Oct. 1949, p. 545-551.

Modern methods and their applicability under prevailing conditions in Brazil. (B14, Th, EG-g)

C

NONFERROUS EXTRACTION AND REFINING

25-C. Harvey Machine Plans $50 Million Aluminum Facility in Nevada. James Joseph. *Western Metals,* v. 8, Feb. 1950, p. 21-23.

Plans include manufacture of carbon electrodes for the reduction process; electrochemical reduction of bauxite; and a rolling mill. (C23, F23, Al)

26-C. Concerning the Thermal Reduction of Magnesium Oxide With Calcium Carbide. (In German.) A. Schneider and G. Hutt. *Zeitschrift für anorganische Chemie,* v. 257, Dec. 1948, p. 289-315.

Experimental equipment used in determining the effect of temperature, grain size, and previous heat treatment. Heat of reaction and equilibrium constants. 35 ref. (C26, Mg)

27-C. Concerning the Production of Metallic Magnesium From Magnesium Oxide by Reduction With Calcium Carbide. (In German.) H. Heinrich Franck and Rudolf Wallongh. *Zeitschrift für anorganische Chemie,* v. 257, Dec. 1948, p. 316-339.

Experimental reduction of MgO with CaC_2 in vacuum and in an inert atmosphere. In vacuum, MgO is reduced above the boiling point of Mg by a simple diffusion process. In an inert atmosphere, maximum reduction is 70%. Heat of reaction was determined. 14 ref. (C26, Mg)

28-C. Removing Hydrogen From Aluminum Melts. (In German.) H. Kalpers. *Archiv für Metallkunde,* v. 3, Dec. 1949, p. 427-428.

Because of the probability that H_2 not only dissolves in Al, but also combines with it, it is shown that additions which merely flush gaseous H_2 from the melt are unsatisfactory. Recommends use of chlorine gas or an undefined material known as "Flussum-Al" to remove chemically combined H_2. (C21, Al)

29-C. Continuous Casting of Light Metals by the Water-Cooling Process. (In German.) Walter Roth. *Zeitschrift für Metallkunde,* v. 40, Dec. 1949, p. 445-460.

Advantages of various continuous casting methods. Data prove the superior strength properties of Al-rich Al-Cu-Mg alloys cast by this method. (C5, Al)

30-C. Casting Equipment for Multiple Casting of Bars and Rods. (In German.) W. Helling and F. Gassner. *Metall,* v. 3, Nov. 1949, p. 367-373; Dec. 1949, p. 418-421.

A continuous casting process which permits close control over metal flow and prevention of oxidation and oxide inclusions. Part 2: Optimum casting rates for pure Al and two of its alloys. Surface micro and macrostructures. (C5, Al)

31-C. Improving the Refining of Copper in the Mansfeld Copper Plant. (In German.) *Metall,* v. 3, Dec. 1949, p. 426.

Involves injection of steam into the copper melt. Advantages of proposed method. (C21, Cu)

32-C. Metallurgical Principles of Tin Smelting. (In German.) G. Mertens. *Metall,* v. 4, Jan. 1950, p. 14-18.

Comprehensive general description of methods of extracting tin from its ores and refining it. Dry and electrolytic refining as well as the "poling" of tin (use of green wood in the bath). (C21, C23, Sn)

33-C. Reduction Potential of Alumina and Mechanism of Its Electrolysis in Industrial Furnaces. II. (In Italian.) A. Vajna. *Alluminio,* v. 18, Nov.-Dec. 1949, p. 599-602.

Summarizes discussion at meeting of the French Electrical Society. Critical analysis of proposed theories indicates that no reliable conclusions can be reached on the basis of existing information. (C23, Al)

34-C. Metal Smelting and Melting Furnaces. (In Dutch.) H. Leusink. *Metalen,* v. 4, Jan. 1950, p. 81-88.

Various types of furnaces used for smelting and melting of nonferrous metals. (C21)

35-C. Production of Magnesium at Painesville, Ohio. J. M. Avery and R. F. Evans. *Transactions of the American Institute of Mining and Metallurgical Engineers,* (Extractive Metallurgy Division), v. 182, 1949, p. 51-58.

Previously abstracted from *Metals Technology.* See item 2-53, 1945. (C23, Mg)

36-C. Pilot-Plant Production of Electrolytic Magnesium From Magnesia. R. R. Lloyd, C. K. Stoddard, K. L. Mattingly, E. T. Ledigh, and R. G. Knickerbocker. *Transactions of the American Institute of Mining and Metallurgical Engineers,* (Extractive Metallurgy Division), v. 182, 1949, p. 68-92.

Previously abstracted from *Metals Technology.* See item 2-55, 1945. (C23, Mg)

37-C. The Mufulira Smelter, Northern Rhodesia. F. E. Buch. *Transactions of the American Institute of Mining and Metallurgical Engineers,* (Extractive Metallurgy Division), v. 182, 1949, p. 127-139.

Previously abstracted from *Metals Technology.* See item 2C-1, 1948. (C21, Cu)

38-C. Roan Antelope Smelter, Northern Rhodesia. R. J. Stevens. *Transactions of the American Institute of Mining and Metallurgical Engineers,* (Extractive Metallurgy Division), v. 182, 1949, p. 140-157.

Previously abstracted from *Metals Technology.* See item 2C-2, 1948. (C21, Cu)

39-C. Evidence of Formation of Copper Ferrite From Reaction Between Cuprous Oxide and Copper Reverberatory Slags. Pei-Yung Huang and C. R. Hayward. *Transactions of the American Institute of Mining and Metallurgical Engineers,* (Extractive Metallurgy Division), v. 182, 1949, p. 158-176.

Previously abstracted from *Metals Technology.* See item 2-28, 1947. (C21, Cu)

40-C. Vacuum Dezincing in Lead Refining. W. T. Isbell. *Transactions of the American Institute of Mining and Metallurgical Engineers,* (Extractive Metallurgy Division), v. 182, 1949, p. 186-189; discussion, p. 189-190.

Previously abstracted from *Metals Technology.* See item 2-82, 1947. (C25, Pb)

41-C. Soda Treatment of Blast-Furnace Drosses at El Paso Smelter. A. A. Collins. *Transactions of the American Institute of Mining and Metallurgical Engineers,* (Extractive Metallurgy Division), v. 182, 1949, p. 191-196; discussion, p. 196-197.

Previously abstracted from *Metals Technology.* See item 2-42, 1947. (C21, Pb, Cu)

42-C. Distillation of Zinc and Refining of Residual Metals From Copper-Base Alloys. F. F. Poland. *Transactions of the American Institute of Mining*

and Metallurgical Engineers, (Extractive Metallurgy Division), v. 182, 1949, p. 198-212.

Previously abstracted from *Metals Technology*. See item 15-25, 1946. (C22, A8, Cu, Zn)

43-C. Effect of Length of Cycle on the Economics of Retort Zinc Smelting. B. M. O'Harra and F. G. McCutcheon. *Transactions of the American Institute of Mining and Metallurgical Engineers*, (Extractive Metallurgy Division), v. 182, 1949, p. 213-221; discussion, p. 221-225.

Previously abstracted from *Metals Technology*. See item 2-84, 1947. (C21, Zn)

44-C. Laboratory Preparation of Lithium Metal By Vacuum Metallurgy. W. J. Kroll and A. W. Schlechten. *Transactions of the American Institute of Mining and Metallurgical Engineers*, (Extractive Metallurgy Division), v. 182, 1949, p. 266-274.

Previously abstracted from *Metals Technology*. See item 2-137, 1947. (C25, Li)

45-C. Vacuum Process for Preparation of Lithium Metal From Spodumene. R. A. Stauffer. *Transactions of the American Institute of Mining and Metallurgical Engineers*, (Extractive Metallurgy Division), v. 182, 1949, p. 275-284; discussion, p. 284-285.

Previously abstracted from *Metals Technology*. See item 2-239, 1947. (C25, Li)

46-C. Combined Power-Industry Utilization of Waste Gases by the Enin Scheme as Applied to Reverberatory-Furnace Melting of Nonferrous Metals. (In Russian.) N. A. Semenenko. *Izvestiya Akademii Nauk SSSR* (Bulletin of the Academy of Sciences of the USSR), Section of Technical Sciences, Nov. 1949, p. 1607-1619.

System is said to result in considerable increase in power efficiency and productivity, decrease in costs, and ability to use lower grade fuels. (C21, EG-a)

47-C. Electrolysis of Nickel Sulfate in a Cell Containing an Impermeable Diaphragm. (In Russian.) D. M. Chizhikov and B. Z. Ustinskii. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, Dec. 1949, p. 1306-1309.

Experiments on the production of cathodic Ni deposits. Effects of electrical and compositional factors. (C23, L25, Ni)

48-C. Conditioning Dwight-Lloyd Gases to Increase Bag Life. R. E. Shinkoskey. *Journal of Metals; Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 188, Mar. 1950, p. 608-609.

Program for increasing the life of woolen bags used for filtering Dwight-Lloyd gases at Selby, Calif., plant of American Smelting and Refining Co., by treating the bags and gases with hydrated lime. Methods and apparatus for determining alkalinity of dusts, acidity and breaking strength of bag cloth. (C21, A8)

49-C. An Improved Automatic Smoke Sampler. J. J. Donoso. *Journal of Metals; Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 188, Mar. 1950, p. 610-612.

Continuous and accurate determination of smoke losses in a smelter. Modern pneumatic differential controlling instruments that allow simultaneous sampling of multiple points using only one filter and one exhaust system. (C21, A8)

50-C. Description of the Refining of a Batch of 150 Tons of Crude Lead, Obtained From the Ore of Ribera de Iguape, Sao Paulo. (In Portuguese.) Tharcisio D. de Souza Santos and Clovis Bradaschia. *Boletim da Associaçao Brasileira de Metais*, v. 5, Oct. 1949, p. 477-492; discussion, p. 492-495.

Experimental equipment and procedure using a blast furnace designed for reduction of iron, and fired with wood. Detailed phase diagrams show desilvering and dezincification in a form not previously published. Simplicity, efficiency, and economy of the process; also a high-quality product. (C21, Pb)

51-C. Aluminothermic Reduction of "Noble" Metal Ores. (In Portuguese.) Eros Orosco. *Boletim da Associacao Brasileira de Metais*, v. 5, Oct. 1949, p. 592-610.

A newly developed modification of the aluminothermic process for reduction of metals such as tungsten, titanium, and zirconium directly from the corresponding ores. Theoretical basis of the process. (C26, W, Ti, Zr, EG-d)

D

FERROUS REDUCTION AND REFINING

44-D. Turbo-Hearth Process Promises Quality Steel in 12 Minutes. C. E. Sims and F. L. Toy. *Steel*, v. 126, Feb. 27, 1950, p. 72, 74, 77. A condensation.

32 heats of new special-process steel were made by surface-blowing 1000-lb. charges of hot basic iron in a basic-lined hearth. Experiments were conducted in a cooperative research project of Carnegie-Illinois Steel Corp. and Battelle Memorial Institute. Openhearth quality steel is made in 12 min. without using external fuel. Basic brick capable of withstanding temperatures over 3000° F. is used to line the hearth chamber. (D2)

45-D. New "Turbo-Hearth" Makes Steel in Twelve Minutes. *Steel Processing*, v. 36, Feb. 1950, p. 79. Based on paper by C. E. Sims and F. L. Toy.

See item 44-D, above. (D2)

46-D. Production of Wrought Iron. Charles R. FonDersmith and Edward B. Story. *Steel*, v. 126, Mar. 6, 1950, p. 92, 94, 96, 99-100, 102.

Development of the wrought iron industry from prehistoric times up to and including today's processes. (D8, Fe)

47-D. Factors Contributing to the Cracking of Medium Carbon Silicon-Killed Steel Ingots. J. A. Warchol. *Blast Furnace and Steel Plant*, v. 38, Feb. 1950, p. 221-222, 224, 253.

Ingots were poured of two steels containing 0.15-0.25% C plus 0.35-0.50% Mn; and 0.25-0.30% C plus 0.70-0.90% Mn. Effects of Mn, S, C, mold and bottom-plate condition, teeming speed, pouring temperature, and rolling-mill practice. (D9, F23, CN)

48-D. Rotary Furnaces for Nodulising the Flue Dust of Blast Furnaces in Luxemburg Steel Works. H. Welter. *Engineers' Digest*, v. 11, Feb. 1950, p. 55. Translated and condensed from *L'Ossature Métallique*, v. 14, Oct. 1949, p. 445-450.

Amount collected is about 160-360 lb. per ton of pig iron. Composition is about that of a good "minette" ore of 36% Fe plus 0.7% Mn and 4-5% coke dust. (D1, Fe)

49-D. Oxygen Speeds Production of Stainless Steels in the Electric Furnace. *Industrial Heating*, v. 17, Feb. 1950, p. 258, 260. Condensed from paper by A. C. Ogan.

Experiences at Duquesne Works of Carnegie-Illinois Steel Corp. (D6, B22, SS)

50-D. Cold Metal Operations and Basic Foundry Practice. *Industrial Heating*, v. 17, Feb. 1950, p. 264, 266, 268, 270, 272, 274, 276, 308.

Reviews 11 papers presented at 32nd annual conference of the National Open Hearth Steel Committee. (D2, ST)

51-D. Construction and Maintenance of Open Hearth Bottoms. *Industrial Heating*, v. 17, Feb. 1950, p. 310, 312-313. Condensed from paper by C. William Conn. (D2, ST)

52-D. High-Speed Camera Registers Physical Reaction of Ironmaking. *Steel*, v. 126, Mar. 13, 1950, p. 119.

Color motion pictures shown at winter meeting of Eastern States Blast Furnace & Coke Oven Assn. Summaries of papers presented. (D1, Fe)

53-D. The Influence of Gas/Solid Temperature Differences on Blast-Furnace Operation. J. Taylor. *Journal of the Iron and Steel Institute*, v. 164, Feb. 1950, p. 129-140.

Effects of major operating variables on gas/solid temperature differences in the stock column of the blast-furnace were calculated, and used in consideration of the extent to which the high-temperature heat requirement, as against total heat requirement, is an overriding factor in carbon efficiency. It is concluded that, only for low slag volumes, low blast temperatures, and high hearth temperatures, is this probably the case for modern furnaces. The general effect of the operating variables on vertical temperature gradient in the stock column is deduced from the temperature differences. 12 ref. (D1, ST)

54-D. Proposals for the Modification of a Blast-Furnace Top to Give Controlled Burden Distribution. E. L. Diamond. *Journal of the Iron and Steel Institute*, v. 164, Feb. 1950, p. 173-180.

Practical engineering design for modifying an existing blast furnace to give control of stockline segregation by the method of using a moving frustum below the big bell. An alternative design, using a fixed frustum, is also presented, which gives nearly as wide a range of control by a somewhat simpler method. Experimental results for each design. (D1, Fe)

55-D. A Large Vacuum Valve and Its Application to an Electric Furnace. W. F. Atkins and G. C. H. Jenkins. *Engineering*, v. 169, Feb. 3, 1950, p. 132. A condensation.

A process has been developed for production of high purity iron on a 25-lb. scale, the last operation consisting of deoxidation of molten iron by hydrogen in a high-frequency furnace installed in a large vacuum-tight tank. Describes and diagrams valve used in connection with this equipment. (D8, Fe)

56-D. American Practice in the Acid Electric Steelmaking Furnace; Special Techniques Increase Output. A. C. Brearley. *Metal Treatment and Drop Forging*, v. 16, Winter 1949-50, p. 253-254, 256, 258.

British author feels that, given the right type of scrap, the process could be adopted with advantage more widely in Britain. (D5, ST)

57-D. Refractories Research in the Open-Hearth Steel Industry. *Engineer*, v. 189, Feb. 10, 1950, p. 168-170.

Survey with emphasis on the work of the British Iron and Steel Research Association. (D2, ST)

58-D. Influence of Moisture Content in the Blast on the Quality of Rails Made From Basic Bessemer Steels. (In French.) I. Godefroy. *Revue de Métallurgie*, v. 46, Dec. 1949, p. 869-871.

Thorough experimental investigation failed to establish a relation between moisture content in the blast and cracks appearing during service. (D3, CN)

59-D. Development and Possibilities of Improving the Thermal Economy of Steel Works. (In German.) Fritz Wesemann. *Stahl und Eisen*, v. 70, Jan. 5, 1950, p. 1-10.

A critical study of the relationships between the specific heat consumption of three steel mills and their productive efficiency. (D general, ST)

60-D. Refining High-Chromium Melts in the Electric Arc Furnace With Pure Oxygen. (In German.) Rudolf Fischer. *Stahl und Eisen*, v. 70, Jan. 5, 1950, p. 10-19; discussion, p. 19-21.

Practicability of process was determined by a series of experiments. The high wear of the furnace lining and the cost of the oxygen are favorably counterbalanced by the reduced loss of alloying elements. Experiments were also made with high-Si and high-Mn chromium scrap. 19 ref. (D5, B22, AY)

61-D. Chemical Reactions in the Blast Furnace. (In German.) Nils Sjögren. *Mitteilungen des Chemischen Forschungsinstitutes der Industrie Österreichs*, v. 3, Dec. 1949, p. 105-109.

Chemical reactions in the ferrous blast furnace, also compositions and effects of slags, and utilization of slag in various industries. (D1)

62-D. Experimental Operation of a Basic-Lined Surface-Blown Hearth for Steel Production. C. E. Sims and F. L. Toy. *Blast Furnace and Steel Plant*, v. 38, Mar. 1950, p. 311-313, 321. A condensation.

See abstract of "Turbo-Hearth Process Promises Quality Steel in 12 Minutes", *Steel*, item 44-D, 1950. (D2, ST)

63-D. Desulphurizing for the Bessemer Process. E. P. Best. *Blast Furnace and Steel Plant*, v. 38, Mar. 1950, p. 314-321.

Development of patented process in which as much as 92% of the S is eliminated by ladle treatment with NaOH prior to bessemerizing. Process was developed by A. M. Byers Co. to make it possible to shift from hand puddling to the Byers process for manufacture of wrought iron. Important implications for the iron and steel industry. (D3, D8, Fe)

64-D. Pig-Casting Machine Practice at Woodward. H. A. Byrns. *Journal of Metals*, v. 188, Mar. 1950, p. 474-475.

Procedure and handling methods used by the Woodward Iron Co. (D1, Fe)

65-D. Pig Machine Practice at Hanna. A. J. Macdonald. *Journal of Metals*, v. 188, Mar. 1950, p. 476-476A.

Equipment and procedure used to produce pig iron at Hanna Furnace Corp. (D1, Fe)

66-D. Lessons From a Hanging Blast Furnace. L. M. Fulton. *Journal of Metals*, v. 188, Mar. 1950, p. 476E-480.

Behavior of a furnace which frequently encountered hanging (when downward movement of stack either ceases or slows down enough to delay charging beyond the proper time). Cause of hanging and changes in furnace design. (D1, ST)

67-D. Iron Without the Blast Furnace. Sven Eketorp. *Canadian Metals*, v. 13, Feb. 1950, p. 6-9, 48.

Sponge-iron research and commercial application. 11 ref. (D8, Fe)

68-D. Open-Hearth Furnace; Practical Aspects of Recent Developments in Design and Operation. A. H. Leckie. *Iron and Steel*, v. 23, Mar. 1950, p. 93-98.

See abstract from *Engineering*, item 10-D, 1950. (D2)

E

FOUNDRY

83-E. Some Factors Influencing the Use of Ethyl Silicate in Precision Casting. H. G. Emblem, A. E. Meadowcroft, and G. E. Stockwell. *Metallurgia*, v. 41, Jan. 1950, p. 157-159.

Evaluates the suitability of a given sample in lost-wax precision-casting processes. (E15)

84-E. The "Lost Wax" Process of Precision Casting. J. S. Turnbull. *Engineer*, v. 189, Jan. 20, 1950, p. 97-99; *Engineering*, v. 169, Jan. 27, 1950, p. 107-109. A condensation.

History, procedures and equipment, and applications in industry. (E15)

85-E. Melting Steel Scrap in the Cupola: A Bibliography. *Bulletin of the British Cast Iron Research Association*, v. 10, Jan. 1950, p. 146-149.

Includes abstracts. 27 ref. (E10, CI)

86-E. Concerning the Properties of Cast Iron Melted in the Electric Furnace. I. (In Japanese.) Toshihiro Kinshita, Akio Odawara, and Kauichi Takagi. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, May 1949, p. 31-35.

Mechanical properties, fluidity, and macrostructural defects were investigated in metals melted in basic and acid electric furnaces. Results are summarized in English. (E25, Q general, CI)

87-E. Production Casting 30-Ton Engine Bases. C. W. Gilchrist. *Iron Age*, v. 165, Mar. 2, 1950, p. 81-85.

Data on handling molds that exceed a foundry's crane capacity and drying oven size. Time required was reduced to two days in the final production setup by development of unique handling and drying methods. (E11, CI)

88-E. Casting Grinding Balls Continuously. Pearson M. Payne and Frank G. Steinebach. *Foundry*, v. 78, Mar. 1950, p. 70-73, 217-219.

Steel grinding balls are produced automatically at a rapid rate by a special machine. Pure-copper, water-cooled, permanent molds are used. (E12, T5, CI, Cu)

89-E. The Cupola—Its Raw Materials and Operation. B. P. Mulcahy. *Foundry*, v. 78, Feb. 1950, p. 76-77, 226-230; Mar. 1950, p. 74-77, 198, 200-202.

Feb.: Recommendations concerning cupola charging equipment, metal charges, and fuel. March: Fundamental laws which govern cupola operation. (E10, CI)

90-E. Influence of Blowhole Diameter, Vent Area and Air Pressure in Core Blowing. Harold M. Gade. *Foundry*, v. 78, Mar. 1950, p. 82-83, 156, 158, 160.

Systematic experimental study made with the objective of eventually reducing core-blowing box design to an orderly science. 13 ref. (E21)

91-E. Ceramic Molds for the Foundry. Thomas A. Dickinson. *Foundry*, v. 78, Mar. 1950, p. 84-86, 144.

Present and potential uses of various types of ceramic materials as permanent molds for casting metals. Methods of making the molds and properties of typical ceramic materials. (E19)

92-E. High Strength Aluminum-Magnesium Alloy Castings. H. F. James. *Foundry*, v. 78, Mar. 1950, p. 87, 196.

Recommended foundry procedures for making sand castings of No. 220 Al-Mg alloy (10% Mg). (E11, Al)

93-E. Cupola Dust Collection. William N. Witheridge. *Foundry*, v. 78, Feb. 1950, p. 84-85, 198-202, 204-205, 208; Mar. 1950, p. 88-91, 220-229.

See abstract from *Heating and Ventilating*, item 14A-180, 1949. (E10, A5)

94-E. The Metallurgical Laboratory in a Nonferrous Jobbing Foundry. W. A. Mader. *Foundry*, v. 78, Mar. 1950, p. 94-97, 230.

(E general, A9, EG-a)

95-E. The Thermal Properties of Non-Metallic Mold Materials. *Industrial Heating*, v. 17, Feb. 1950, p. 306, 308. Condensed from paper of similar title.

Previously abstracted from paper by R. W. Ruddle and A. L. Mincher, *Journal of the Institute of Metals*. See item 14A-170, 1949. (E19)

96-E. Suction Casting. V. N. Grudinsky, I. B. Khazan, and I. I. Finger. *Engineers' Digest*, v. 11, Feb. 1950, p. 59. Translated and condensed from *Avtomobilnaya Promyshlennost* (Automobile Industry), Aug. 1949, p. 19-21.

Improved arrangements applied to a variety of cast iron and aluminum castings including Russian automobile cylinder blocks. (E16, CI, Al)

97-E. The Mechanism of Solidification of Horizontal Steel Castings. D. R. F. West. *Journal of the Iron and Steel Institute*, v. 164, Feb. 1950, p. 182-194.

Factors which influence the macrostructures of horizontally cast steel blocks were investigated with special reference to temperature conditions and rates of solidification. Experiments were made to determine temperature conditions during the solidification of sand and chill castings, by inserting thermocouples into the mold cavity, and measuring the temperatures at intervals after pouring. Liquidus-solidus ranges of some commercial steels were investigated. 17 ref. (E25, ST)

98-E. Gas Burner Production at Stockport. A. Graham Thomson. *Foundry Trade Journal*, v. 88, Feb. 9, 1950, p. 147-149, 151.

British plant for casting of gas burners and other small iron castings. (E11, CI)

99-E. Casting Design as Influenced by Foundry Practice. Oliver Smalley. *Foundry Trade Journal*, v. 88, Feb. 9, 1950, p. 153-154.

Patternmaking in connection with design. (E17)

100-E. Standardised Gating for Moulds Cast Vertically. *Foundry Trade Journal*, v. 88, Feb. 9, 1950, p. 155. (E22)

101-E. The "Lost-Wax" Process of Precision Casting. J. S. Turnbull. *Foundry Trade Journal*, v. 88, Feb. 16, 1950, p. 179-188.

Historical aspects of the process. Sequence of operation, die and pattern making, investment and casting. Properties of castings and economics of production are related to present-day market potential. (E15)

102-E. Measurement and Regulation of the Rate of Gas Flow in the Foundry. (In French.) Henri Laplanche. *Fonderie*, Nov. 1949, p. 1819-1835; Dec. 1949, p. 1851-1868.

Different types of apparatus as applied to the cupola. Structural details and applications of each type. 18 ref. (E10, S18)

103-E. One-Piece Casting of "Francis" Turbine Rotors for a Central Power Station. (In French.) *Fonderie*, Dec. 1949, p. 1869-1872.

Casting and rigging for rotors having a diameter of 4.525 meters and weighing 42 tons. (E11, E22, CI)

104-E. Technical Status and Applicability of Die Casting. (In German.)

K. Schneider and O. Barnickel. *Metall*, v. 3, Dec. 1949, p. 409-414.

Various processes, their advantages and disadvantages; mold types; mold cooling methods; shrinkage allowances for different metals and alloys; and types of pieces most suitable for the process. (E13)

105-E. Effect of Stirring on Grain Size of Solidifying Light-Metal Melts and on the Properties of Light Metals. (In German.) F. Sauerwald. *Metall*, v. 3, Dec. 1949, p. 414-415.

Experiments on Al and Mg-base alloys show that stirring in the mold, ladle, or crucible has a refining effect on the grain structure of the castings but does not always improve their mechanical properties. (E25, Al, Mg)

106-E. Research on the Formation of Cavities (Blowholes) in Castings. (In German.) Franz Roll. *Neue Giesserei*, v. 37 (new ser., v. 3), Feb. 9, 1950, p. 45-52.

Experiments made to determine the effects of various factors. Preventive measures. (E25)

107-E. Modernization Trends in the Small Foundry. Lester B. Knight. *Canadian Metals*, v. 13, Feb. 1950, p. 26-29.

Case histories show what can be done with modest capital expenditures. (E general)

108-E. Mechanized Job-Shop Foundry for Aluminum. C. H. DeLamater. *Mechanical Engineering*, v. 72, Mar. 1950, p. 211-215.

Foundry produces both sand and permanent-mold Al alloy castings ranging from a few ounces to several hundred pounds in weight. (E11, E12, A5, Al)

109-E. Multiple Casting Speeds Output of Bearing Caps. Charles H. Wick. *Machinery* (American), v. 56, Mar. 1950, p. 133-137.

Four Dodge and Plymouth cast-iron main-bearing caps are combined in one casting, resulting in increased production and accuracy. Machining operations. (E11, G17, T21, CI)

110-E. For Smooth Operation of the Casting Wheel. R. B. Moore. *Engineering and Mining Journal*, v. 151, Mar. 1950, p. 66-69.

The casting wheel is used in pouring of copper anodes and wire bars. Operating features and advantages obtainable on casting machine with Ward-Leonard drive and flywheel-damping-motor acceleration control. (E23, Cu)

111-E. Moulding Technique Aids Production. S. R. Bridger. *Foundry Trade Journal*, v. 88, Feb. 23, 1950, p. 195-200.

Improvements in molding and coremaking techniques which improved the rate of production and yield of good castings per ton of metal. (E19, E21)

112-E. Basic Principles of Die Design. H. K. Barton and L. C. Barton. *Machinery* (London), v. 76, Feb. 23, 1950, p. 273-280.

Refers to die casting. (E13)

F

PRIMARY MECHANICAL WORKING

44-F. Forging With Controlled Atmospheres. C. A. Carlson. *Industrial Gas*, v. 28, Feb. 1950, p. 11, 27.

Forging furnace for use in manufacture of pole-line hardware. (F22)

45-F. Die Sinking for Drop Forging. Part VII. Preliminary Operations. John Mueller. *Steel Processing*, v. 36, Feb. 1950, p. 76-79. (F22)

46-F. Rolled and Forged Circular Products Produced on Special Mill by Bethlehem. *Steel Processing*, v. 36, Feb. 1950, p. 84-86.

Mill practice. Includes heat treatment (heating, quenching, and tempering). (F23, J general, ST)

47-F. Huge Billet Shear Cuts Drop Forging Slugs to Accurate Length for End Use in Automobile Components. *Steel*, v. 126, Feb. 27, 1950, p. 78. (F29)

48-F. The Hot Working of Nickel and High-Nickel Alloys. *Metallurgia*, v. 41, Jan. 1950, p. 127-133.

Success depends upon correct heating. Means and time of heating, and temperatures for various operations. Important aspects of hot working for developing techniques to insure the most desirable properties. (F21, Ni)

49-F. Hot Working. I. (In Japanese.) Tadao Sato. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, June 1949, p. 1-3.

The relationships between mechanical properties of extruded Al and Mg alloys, chemical compositions, and working conditions. (F24, Q general, Al, Mg)

50-F. Use of Molybdenum Widens. *Iron Age*, v. 165, Mar. 2, 1950, p. 94.

New production technique by which ingots averaging 50 lb. in weight are made. Slab ingots for plate and sheet rolling or rounds for rod rolling are readily formed. The green-pressed pieces are surface-conditioned and then treated by a special high-temperature process. (F general, Mo)

51-F. Rod Caps Forged Ten to the Bar. Herbert Chase. *Automotive Industries*, v. 102, Mar. 1, 1950, p. 36-37.

Forging equipment. SAE 1038 round bar stock is used. (F22, T21, CN)

52-F. Integrally Stiffened Structures. Paul Sandorff and G. W. Papen. *Aeronautical Engineering Review*, v. 9, Feb. 1950, p. 30-38.

Several methods are available for manufacturing large integrally stiffened surface panels, for example: extrusion, forging, rolling, casting, machining from plate, etc. Advantages, limitations, and potentialities of each method are discussed. (F general, G general, T26)

53-F. How Is Capillary Tubing Made? L. E. Gibbs. *Refrigerating Engineering*, v. 58, Mar. 1950, p. 252-254, 290.

Production and testing of seamless copper capillary tubing, usually between 0.026 and 0.049 in. i.d., to tolerances as close as ± 0.001 in. Hot extrusion of a large hollow-shell is followed by a series of cold drawing operations. (F24, Cu)

54-F. How To Choose Wire Drawing Lubricants. E. L. H. Bastian. *Iron Age*, v. 165, Mar. 9, 1950, p. 65-69, 86.

Lubricant recommendations for rod, intermediate wire, and fine wire drawing in wet and dry systems. Information applicable to common ferrous and nonferrous metals. (F1, F27)

55-F. Fundamentals of Drop Forging Design. F. Walker. *Metal Treatment and Drop Forging*, v. 16, Winter 1949-50, p. 219-224.

The importance of design of drop forgings and its effects on rate of production and die life. Position of the parting plane, in individual basic shapes, and then in more complicated shapes. Die tolerances and machine allowances. (F22)

56-F. The Hot Rolling of Aluminium and Its Alloys. F. Kasz and P. C. Varley. *Journal of the Institute of Metals*, v. 76, Jan. 1950, p. 407-428.

Current practice. Preheating of the rolling slab. Physical and metallurgical aspects and mode of deformation. Effect of hot rolling upon metallurgical constitution and influence of hot rolling variables upon behavior of the finished product after final cold rolling. (F23, Al)

57-F. The Extrusion of Aluminium Alloys. Christopher Smith. *Journal of the Institute of Metals*, v. 76, Jan. 1950, p. 429-451.

Die manufacture, and the nature of the flow that normally occurs in the extrusion of nonferrous alloys. Problems associated with the production of heat treated alloys in the form of extrusions. (F24, Q24, Al)

58-F. The Hot Forging and Hot Stamping of Aluminium and Its Alloys. F. E. Stokeld. *Journal of the Institute of Metals*, v. 76, Jan. 1950, p. 453-472.

General aspects and some differences between the forging of these materials and the forging of steels. Strength and ductility at particular locations in the forgings. Influences of various factors. 34 ref. (F22, G3, Q23, Al)

59-F. The Hot Working of Magnesium and Its Alloys. R. G. Wilkinson and F. A. Fox. *Journal of the Institute of Metals*, v. 76, Jan. 1950, p. 473-500.

Current practice in rolling, extrusion, and forging. Importance of the direct-chill casting process; stock so produced in the new Zn-containing high-strength alloys can be hot worked over a wide temperature range. British research which has shown that modern Mg-base alloys can be hot worked under drastic conditions similar to those applied to mild steel. Possible future developments. 24 ref. (F22, F23, F24, Mg)

60-F. The Hot Working of Copper and Copper Alloys. Maurice Cook and Edwin Davis. *Journal of the Institute of Metals*, v. 76, Jan. 1950, p. 501-526.

Metallurgical and operational factors. Various tests for evaluating hot working properties and their applicability. Hot workability of various alloys such as the brasses, Al bronzes, Ni silvers, cupro-nickels, and Si bronzes; effect of composition as related to constitution; effect of additional alloying elements and impurities. Metallurgical features of industrial hot working processes, such as rolling, extrusion, piercing, and forging. 32 ref. (F general, Q23, Cu)

61-F. The Hot Working of Tin Bronzes. D. W. Dugard Showell. *Journal of the Institute of Metals*, v. 76, Jan. 1950, p. 527-540.

Influence of various factors on the hot working of phosphorized Sn bronzes. Use of pure materials is thought to be essential, because of the tendency of low-melting-point impurities to segregate in the grain boundaries. Harmful effects both of these impurities and of tin sweat can be reduced by controlled melting and pouring. 13 ref. (F general, Q23, Cu)

62-F. The Hot Working of Lead and Lead-Rich Alloys. L. H. Back. *Journal of the Institute of Metals*, v. 76, Jan. 1950, p. 541-556.

Sheathing of cable by both lead presses and extrusion machines. The manner in which certain extrusion faults take place. Production of lead pipe, lead sheet, and collapsible lead tubes. (F24, Pb)

63-F. The Rolling of Zinc and Zinc-Rich Alloys. C. W. Roberts and B. Walters. *Journal of the Institute of Metals*, v. 76, Jan. 1950, p. 557-580.

Methods used for production of Zn and Zn-alloy sheet and strip; brief reference to the manufacture of other rolled forms. Metallurgical

problems associated with the rolling operations, and effect on mechanical properties. 18 ref. (F23, Q general, Zn)

64-F. Determining the Required Efficiency in Bar-Steel Drawing. (In German.) Fritz Boehm. *Stahl und Eisen*, v. 69, Dec. 8, 1949, p. 931-938.

The energy consumption of drawbench motors used in the drawing of seven groups of steel under widely different operating conditions was determined and a method of determining drawing efficiency in relation to reduction in cross-section at various drawing rates was derived. Graphs show the effect of drawing rate, initial strength, and initial and final bar diameters on energy consumption. 6 ref. (F27, CN)

65-F. Production of Sewing Machine Needles for the Garment Industry. (In German.) Joachim F. Wallenstein. *Stahl und Eisen*, v. 69, Dec. 22, 1949, p. 943-948.

Different types of needles (including phonograph needles and shoemaker's needles) and the sequence of operations required in their production. Properties of needle steels. (F28, T10, CN)

66-F. Requirements of the Wire Used for Sewing-Machine Needles. (In German.) Bernhard Schmetz and Heinz Kensche. *Stahl und Eisen*, v. 69, Dec. 22, 1949, p. 948-958.

Surveys stresses applied to the wire in the production of the needles and to the finished needles in the sewing operation. Composition, treatment, and properties of suitable needle steel. Methods of testing the steel. (F28, T10, CN)

67-F. Sources of Loss in Production of Sheets of the Al-Cu-Mg Alloy "Cu 30". (In German.) Franz Klein. *Metall*, v. 4, Feb. 1950, p. 54-55.

Causes of scrap based on experiences of three rolling mills. Compositions were as follows: 3.1-3.3% Cu; 0.6-0.7% Mn; 0.3-0.5% Fe; 1.3-1.4% Mg; 0.4-0.5% Si; remainder, Al. (F23, Al)

68-F. Rolls and Rolling. Parts XII and XIII. E. E. Brayshaw. *Blast Furnace and Steel Plant*, v. 38, Feb. 1950, p. 196-206; Mar. 1950, p. 322-330.

Feb. issue: Roll-pass diagrams for flat sections. Spreads and fillets, the step roll, edging-pass alignment, and the fluted square. Mar. issue: Various flat products. (To be continued.) (F23)

69-F. Fast Heating Improves Forgeability. Charles A. Turner, Jr. *Steel*, v. 126, Mar. 20, 1950, p. 76-79, 103-104, 106.

Easier metal flow, resulting in 23% deeper penetrations in steel heated rapidly by the radiant gas method, is one of the unexpected results obtained from recent laboratory investigations. Reduced scale and decarburization are among the other benefits. Macrographs show influence of heating time, atmosphere, temperature, and composition on structures and penetration. (F21, ST)

70-F. Production of Forgings. Waldemar Naujoks. *Steel*, v. 126, Mar. 13, 1950, p. 106, 108, 110, 113-114, 116; Mar. 20, 1950, p. 91, 94, 96, 98, 100, 103.

Equipment and procedures. (F22)

71-F. Cold Rolling Technique; The Application of Theory and Experiment to the Practice of Rolling. 6. Methods of Calculating Roll Force and Torque Based on Theories of Rolling. Hugh Ford. *Sheet Metal Industries*, v. 27, Feb. 1950, p. 101-108; Mar. 1950, p. 197-202, 207.

Details of methods illustrated by worked examples. (Series to be continued.) (F23)

72-F. Hearth Maintenance. Charles N. Jewart. *Iron and Steel*, v. 23, Mar. 1950, p. 107-108.

As applied to batch-type regenerative furnaces and single, double, and triple-fired continuous furnaces with recuperators, in the steel mill. (F21)

73-F. (Book) **Designing With Aluminum Extrusions.** H. V. Menking. 138 pages. Reynolds Metals Co., 2500 S. Third St., Louisville 1, Ky.

Breaks down advantages of the extrusion process into eight principles of design. (F24, Al)

G

SECONDARY MECHANICAL WORKING

72-G. Marform: A New Press Drawing Tool. Thomas E. Lloyd. *Iron Age*, v. 165, Feb. 23, 1950, p. 78-81.

Using the best features of rubber-press forming and steel die drawing, new process permits deeper draws, lower tool costs, and economical production on both large and small runs. It eliminates finish forming and handles various materials and thicknesses without tool changes. By forming prepainted or finished stock it cuts finishing costs. (G1)

73-G. New Forming Process Demonstrated. John C. McComb. *Steel Processing*, v. 36, Feb. 1950, p. 80-83.

"Marform" process which produces deep draws in aluminum and steel, and is based on the use of rubber as a substitute for the usual female die, with a movable male die made of steel, Kirksite, or masonite. (G1)

74-G. Hot Machining. Guy Hubbard. *Steel*, v. 126, Feb. 27, 1950, p. 60-62.

Destined to speed up production of hard, tough parts, novel system foreshadows distinct types of "heating-cutting" machine tools. (G17)

75-G. Deeper Draws at Less Cost. *Steel*, v. 126, Feb. 27, 1950, p. 66-68, 70.

Reduced tooling costs in low and high volume production, greater tapers without wrinkles, and elimination of hand finish-forming are some advantages cited for Marform process. Success of method is the result of precision control of pressure curve during the forming cycle. (G1)

76-G. Reconstruction of French Sheet Mill; Details of New Equipment. *Sheet Metal Industries*, v. 27, Feb. 1950, p. 109-110, 116.

New steel rolling and annealing equipment. (F23, J23, ST)

77-G. Factors Affecting the Occurrence of "Ears" in the Deep Drawing of Aluminium and Its Alloys. R. Chevigny. *Sheet Metal Industries*, v. 27, Feb. 1950, p. 133-140, 148.

Previously abstracted from *Revue de l'Aluminium*. See item 19D-35, 1949. (G4, Al)

78-G. Chemico-Mechanical Grinding of Hard Metal Tips. *Metallurgia*, v. 41, Jan. 1950, p. 133-134. From article by R. M. Kolker, *Stanki i Instrument* (Machine Tools and Equipment), 1949, p. 17-19.

Combined chemical and mechanical method. Importance of surface grinding metal tool tips before brazing. (G18)

79-G. Chevrolet's Torque Converter: How It Is Made of Precision Cold Formed Steel Parts. Joseph Geschelin. *Automotive Industries*, v. 102, Mar. 1, 1950, p. 38-42, 56.

Miscellaneous fabrication procedures including forming, welding, brazing, annealing, etc. (G1, A5, T21, ST)

80-G. New Metal Forming Process. H. H. Roberts. *Automotive Industries*, v. 102, Mar. 1, 1950, p. 43, 55.

Marform process for sheet metal parts developed by Glenn L. Martin Co. It employs a simple punch for the male portion of the die and rubber under controlled pressure for the female portion. (G1)

81-G. Notes on Machining Stainless Steel. R. H. King. *Aircraft Engineering*, v. 22, Feb. 1950, p. 55-56.

Some practical problems. (G17, SS)

82-G. Are Shop Men Scared of High-Speed Machining? E. J. Tangerman. *American Machinist*, v. 94, Mar. 6, 1950, p. 85-89.

Indicates that the industry as a whole is not taking full advantage of the known machinability of ferrous materials with carbide tools, nor even using high speed steel as well as it can be used. Tells what a few shops are doing to slash costs by improving finish and tool life and reducing power consumption and time requirements. (G17)

83-G. Novel Repair Saves High Replacement Cost. *Iron Age*, v. 165, Mar. 9, 1950, p. 70-72.

How Kaiser repaired broken mill spindle by burning off the fractured end and machining it to fit a new jaw, then shrinking the cast-steel jaw onto the original forging. (G17, K13, CN)

84-G. Aluminum Boats. Charles Bruno and G. W. Birdsall. *Industry & Welding*, v. 23, Mar. 1950, p. 37-38.

Production by stamping and welding. (G3, K general, Al)

85-G. Nimonic Alloys; A Detailed Survey of Modern Machining Practice. *Automobile Engineer*, v. 40, Feb. 1950, p. 57-58.

General considerations, milling, milling cutters, broaching, turning, grinding, boring, and drilling of British Al alloys. (G17, Al)

86-G. Impact Extrusion. *Machinery* (London), v. 76, Feb. 9, 1950, p. 192-196.

As applied to production of hollow Al and Zn parts. Selection of steels for punches and dies, lubrication, and mechanism of the process. Micrographs show structures produced. Effects on hardness. (G5, Q29, Al, Zn)

87-G. Longitudinal Anodic-Mechanical Saw. (In Russian.) Kh. M. Sarbash. *Stanki i Instrument* (Machine Tools and Equipment), v. 20, Nov. 1949, p. 15-16.

Convenient portable apparatus incorporating a type of saw in which a surface-active electrolyte is supplied to the cutting-tool point, thus permitting cutting of surface-hardened material without preliminary heat treatment. (G17)

88-G. Surface Finishing Stainless Steel. L. F. Spencer. *Iron Age*, v. 165, Mar. 9, 1950, p. 73-77; Mar. 16, 1950, p. 82-85.

Major considerations and recommendations of equipment and methods as related to physical properties. First part: Grinding. Second part: Polishing and buffing. (G18, L10, SS)

89-G. Electro-Hydraulic Production of Cranks. *Canadian Metals*, v. 13, Feb. 1950, p. 38-39.

New process which has combined several operations into one. Electrical-resistance heating followed by hydraulic bending is the principle of the machine. (G6, CN)

90-G. A Comparison of Machining of Die Cast Vs. Sand Cast Pump Covers. *Die Castings*, v. 8, Mar. 1950, p. 47-48.

Reduction from five to one-station machining achieved by change to die castings. (G17, E13)

91-G. Transfer Machine—Pros Out-

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weigh Cons. *SAE Journal*, v. 58, Mar. 1950, p. 48-50. Based on papers by D. C. Burnham, O. R. Goodrich, and A. W. Zimmer.

Experiences of Reo, Oldsmobile, and Packard show why transfer machines are gaining popularity. How to use them and possible savings. (G17)

92-G. New Concepts of Abrasive Properties as Affecting Grinding Performance. H. W. Wagner. *Mechanical Engineering*, v. 72, Mar. 1950, p. 225-226.

(G18)

H

POWDER METALLURGY

19-H. Sintered Semiconducting Materials. Henry H. Hausner and Herbert B. Michaelson. *Ceramic Age*, v. 55, Feb. 1950, p. 78-80, 106-107.

Recent research on the development of semiconducting ceramic and metal-ceramic bodies. Although it is not believed that all of the variables have been identified, results of a large number and variety of experiments have led to a series of positive conclusions. 16 ref. (H general)

20-H. Making Jet Engine Compressor Blades by Powder Metallurgy. George Stern and John A. Gerzina. *Iron Age*, v. 165, Feb. 23, 1950, p. 74-77.

How infiltration of copper into an iron skeleton, plus sintering, coining, and heat treating, produce a high-strength blade cheaper than conventional forgings. (H16, T25, Fe, Cu)

21-H. Development of Powder Metallurgy; Important Contribution of the Metallwerk Plansee. *Chemical Age*, v. 62, Feb. 4, 1950, p. 195-198. Translated and condensed from report by R. Kieffer and F. Benesovsky, *Journal of the Technical Museum* (Vienna, Austria.)

Work of Austrian plant in development and production of powdered-metal products. (H general)

22-H. The Reduction of Tungsten Oxide With Hydrogen. I. Nature of the Metal Powder. (In Japanese.) Nobuji Sasaki and Ryuzo Ueda. *Science of Powder*, v. 3, no. 1, 1949, p. 1-7.

Microscopic observation revealed that the reduction product of a single WO_3 crystal consists of approximately 0.5μ particles, or "primary particles", which are single crystals formed by "atomic sintering" of W atoms produced by the reduction. If an oxide crystal lying on a surface is reduced, these primary particles remain scattered on the substratum, marking the exact contour of the original oxide crystal. But, if reduced in free space, they stick loosely together to form an aggregate or "secondary particle" which retains the original shape with about 30% contraction. If a mass of WO_3 crystals are reduced, secondary particles may cling loosely together to form "tertiary particles", etc. (H10, W)

23-H. Concerning the Structure of Porous Bodies. (In Japanese.) M. Kawakani. *Science of Powder*, v. 3, no. 1, 1949, p. 8-11.

Experimental work. (H11)

24-H. Effect of Powder Character Upon Compressing and Sintering Operation; Mainly Iron Powders Crushed by Stamp and Eddy Mills. (In Japanese.) Kazuhiko Ogawa and Toraji Nishijima. *Science of Powder*, v. 3, no. 1, 1949, p. 12-18.

Experimental data. (H14, H15, Fe)

25-H. Powder Metallurgy. Willard D. Labrum. *Journal of the American Society of Naval Engineers*, v. 62, Feb. 1950, p. 63-96.

History, processes, properties and applications. 24 ref. (H general)

26-H. Concerning the Kinetics of Sintering. (In German.) Gustav F. Hüttig. *Zeitschrift für Elektrochemie und angewandte Physikalische Chemie*, v. 54, Jan. 1950, p. 89-91.

Reviews the literature. Effect of time and temperature of sintering of Cu powder compacts on electrical conductivity, density, and sonic conductivity. Light and electron-microscope observations clarify the nature of the phenomena. 10 ref. (H15, Cu)

27-H. Electrolytic Production of Highly Dispersed Powdered Iron. (In Russian.) N. T. Kudryavtsev and E. A. Tereshkovich. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 22, Dec. 1949, p. 1298-1305.

Conditions of electrolysis (temperature, current density, etc.), and composition of electrolyte in order to obtain cathodic sponge iron. 11 ref. (H10, Fe)

J

HEAT TREATMENT

51-J. Economical Inert Gases Serve Industry in Many Ways. Edward J. Funk, Jr. *Industrial Heating*, v. 17, Jan. 1950, p. 58-60, 62, 64, 66, 68, 70.

Applications in heat treatment of ferrous and nonferrous metals, in welding, and in fire and explosion protection. Generating equipment is illustrated. (J2, K general)

52-J. New Machines for Flame Hardening. H. V. Inskeep. *Steel Processing*, v. 36, Feb. 1950, p. 91-96.

Details of machines and some typical products. (J2)

53-J. From a Metallurgist's Notebook; Embrittlement of Gold. H. H. Symonds. *Metal Industry*, v. 76, Feb. 3, 1950, p. 91-93.

The importance of correct annealing conditions is stressed in conclusions derived from a thorough metallurgical investigation of the causes of cracking in 9-carat gold watch cases and strip. The alloy contained approximately 44% Cu, 37% Au, 10% Ag, 8% Zn, and 0.014% Bi. (J23, Cu, Au)

54-J. Fundamental Study of Mild Carburization. I. (In Japanese.) Masuo Kawakami and Eisho Fuji. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, May 1949, p. 6-9.

Means of preventing excess carburization of Cr steel, resulting in brittleness, by use of charcoal plus promoters such as $BaCO_3$ or Na_2CO_3. Suppressors are classified into three types—silicate, aluminate, and phosphate. Mechanism of action of the first was investigated. 15 ref. (J28, AY)

55-J. Concerning the Heat Treatment and Magnetic Properties of W-Cr Magnet Steel. (In Japanese.) Sadao Koshiba, Gosaburo Inagaki, and Terumi Nishinuma. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, June 1949, p. 8-11.

Results of experimental investigation. Optimum heat treatment schedules. (J general, P16, SG-n)

56-J. Concerning the Mild Carburization of Chromium Steel. I-IV. (In Japanese.) Hisao Matsumoto. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, June 1949, p. 19-28.

Experimental and theoretical investigation of the use of various carburizers and promoters applied to 1% Cr steel. 26 ref. (J28, AY)

57-J. Carburization of Th-W Filaments. (In Japanese.) Tokuhiko Motida. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, June 1949, p. 31-35.

When the Th-W filaments used in vacuum tubes are heated in a carburizing atmosphere, a layer of W_2C can be formed on their surfaces. This layer increases the thermionic emissivity of the filament. Hence conditions of formation of the layer were studied by microscopic methods. (J28, P17, T1, Th, W)

58-J. Infrared Radiant Heating. Harold J. Garber and F. M. Tiller. *Industrial and Engineering Chemistry*, v. 42, Mar. 1950, p. 456-463.

Use of radiation in heating of materials of low thermal conductivity. Simplified graphical solutions for temperature vs. time at the top, center, and bottom of slabs subjected to radiation. With high radiant intensities, it is possible to heat the surface of a thick material having a low thermal conductivity to a high temperature in a short period of time without greatly elevating subsurface temperatures. (J2)

59-J. Flame Hardening Special Bearings of Unusual Design. J. D. Fitzpatrick. *Western Machinery and Steel World*, v. 41, Feb. 1950, p. 112.

(J2, T7)

60-J. Customer's Heat Treating Problems Solved in Hayes Demonstration Laboratory. *Industrial Heating*, v. 17, Feb. 1950, p. 250-252, 254, 256.

A service laboratory. (J general)

61-J. Successful Operation of a Modern Commercial Heat Treating Plant. George H. Porter, III, and E. J. Jeffries. *Industrial Heating*, v. 17, Feb. 1950, p. 316-320, 322, 324, 326, 328.

Equipment and procedures of Geo. H. Porter Steel Treating Co., Cleveland. (J general)

62-J. Flame Hardening Techniques. F. McGuire. *Industry & Welding*, v. 23, Mar. 1950, p. 22-25, 66-67.

(J2)

63-J. Flash Annealing; Continuous Furnace for Aluminium Alloy Sheets and Circles. *Metal Industry*, v. 76, Feb. 10, 1950, p. 110.

(J23, Al)

64-J. Twist Drill Manufacture. *Machinery* (London), v. 76, Feb. 9, 1950, p. 188-191.

Procedures and equipment for hardening and tempering, brazing, and finish grinding. (J26, K8, G18, TS)

65-J. Some Recent Progress in Treatment of Steel Parts. (In French.) J. Pomey, F. Goutel, R. Coudray, and L. Abel. *Revue de Métallurgie*, v. 46, Dec. 1949, p. 825-842.

Reviews recent literature on heat treatment of different types of steel. 24 ref. (J general, ST)

66-J. The Applicability of Isothermal Hardening in the Production of Unalloyed Steel Wires. (In German.) Anton Pomp and Günter Gesche. *Stahl und Eisen*, v. 70, Jan. 19, 1950, p. 52-57.

Three steel wires (0.37, 0.50, and 0.62% C) were isothermally hardened by quenching in salt baths from 925 to 300-450° C. Various mechanical properties of the subsequently drawn wires were determined and compared with those of other wires. 21 ref. (J26, J2, Q general, CN)

67-J. Plant Experiences With Direct Resistance Heating for Patenting of Steel Wires. (In German.) Karl Zankel. *Stahl und Eisen*, v. 70, Jan. 19, 1950, p. 58-62.

Development and operation of steel

wire patenting methods and equipment. Ways of eliminating operational difficulties. Advantages over electrically heated muffle furnaces. (J25, CN)

68-J. High-Frequency Heat Treating Parts of Peat-Processing Equipment. (In Russian.) A. V. Bolotina. *Torfnaya Promyshlennost* (Peat Industry), v. 26, Nov. 1949, p. 17-19.

Characteristics of induction furnace used and method of oil or water quenching. Optimum operating conditions for parts of different compositions. (J2, ST)

69-J. The Selection of Furnaces in Heat Treatment. Islay S. Reid. *Canadian Metals*, v. 13, Feb. 1950, p. 31-33, 35, 51.

Discussion clarified by examples. (J general)

70-J. Strain Aging in Welding Structural Steel. *Welding Journal*, v. 29, Mar. 1950, p. 132s-133s.

R. E. Lorentz, Jr., and Wells E. Ellis discuss above paper by W. H. Bruckner and S. W. Sandberg (Sept. 1949 issue). Includes authors' replies. See item 18B-171, 1949. (J1, K9, CN)

71-J. Methods of Measuring Case Depth of Steel. *SAE Journal*, v. 58, Mar. 1950, p. 51-54.

SAE Recommended Practice. (J28, ST)

72-J. Controlled Atmospheres; Principles and Applications in the Ferrous Field. D. M. Dovey and I. Jenkins. *Iron and Steel*, v. 22, Dec. 1949, p. 645-648; v. 23, Jan. 1950, p. 33-36; Feb. 1950, p. 69-72; Mar. 1950, p. 105-107.

Dec. issue: Chemistry of controlled atmosphere processes; gas-steel reactants—the role of nitrogen. Jan. issue: Roles of oxygen, hydrogen, carbon, sulfur, and ammonia. The mixed atmospheres N_2-H_2-H_2O, N_2-CO-CO_2, and N_2-H_2-H_2O-CO-CO_2-C_xH_y. Feb. issue: Atmospheres of controlled and varying oxygen potentials; scrubbing of atmospheres; and some general applications. Mar. issue: Combined carburizing and nitriding treatments, metallizing (chromizing, siliconizing, etc.); possible future developments. (J2, L11, Fe)

73-J. Influence of Some Additions on the Rate of Carburization of Steel by Charcoal. (In Czech.) Josef Doskar. *Hutnické Listy*, v. 4, Nov. 1949, p. 345-351; Dec. 1949, p. 389-391.

Influence of $BaCO_3$, $SrCO_3$, Li_2CO_3, Na_2CO_3, and K_2CO_3 on rate of carburization of steels was investigated at 800° C. Recommended mixtures are described. 10 ref. (J28, ST)

K

JOINING

140-K. Aircomatic Fabrication of Gas Heaters. *Iron Age*, v. 165, Feb. 23, 1950, p. 86-87.

Use of inert-gas shielded-arc process for fabrication of heaters made from Alcoa sand-casting alloy No. 108. (K1, Al)

141-K. Design for Spot Welding Aluminum. Gilbert C. Close. *Light Metal Age*, v. 8, Feb. 1950, p. 6-7, 32. (K3, Al)

142-K. Cold Pressure Welding. *Light Metal Age*, v. 8, Feb. 1950, p. 14-15.

Emphasis on applications to Al. (K5, Al)

143-K. Aluminum Awnings by Aircomatic Welding Process. *Light Metal Age*, v. 8, Feb. 1950, p. 22. (K1, Al)

144-K. Details of Some Recent Developments in the Joining of Sheet Material by Spring-Joint Methods. (Concluded.) W. Cookson. *Sheet Metal Industries*, v. 27, Feb. 1950, p. 123-125.

Examples of some drum and packing-box closures. (K13)

145-K. Modern Refrigerator Production at the Hendon Plant—Frigidaire Division of General Motors Ltd. (Concluded.) J. Peers. *Sheet Metal Industries*, v. 27, Feb. 1950, p. 141-146.

Welding equipment and procedures applied to various ferrous and nonferrous components. (K general, T10)

146-K. Welding Research and Production in the U. S. A. H. G. Taylor. *Sheet Metal Industries*, v. 27, Feb. 1950, p. 159-162.

An illustrated survey. 12 ref. (K general)

147-K. Wood's Metal Replaces Assembly Fixtures. Ben C. Brosheer. *American Machinist*, v. 94, Mar. 6, 1950, p. 116-118.

How turbine blades for hydraulic torque converters are set in place with low-melting-point alloy instead of complicated fixtures, prior to riveting. (K13, T5, Bi)

148-K. Carbide Tool Design for Freedom From Brazing Stress. (Continued.) Malcolm F. Judkins. *Tool & Die Journal*, v. 15, Mar. 1950, p. 44-46. (K8, SG-j)

149-K. Cold Pressure Welding of Non-Ferrous Metals. *Production Engineering & Management*, v. 25, Mar. 1950, p. 63-64. (K5, EG-a)

150-K. Band Saw Welding. S. R. Chase. *Wood*, v. 5, Jan. 1950, p. 31.

Specialized procedure using special jigs, gas fusion welding, forging, and tempering. (K2, J29, ST)

151-K. Silver Soldering on Intake Manifold Line. W. Joseph Hutts and William F. Rader. *Western Machinery and Steel World*, v. 41, Feb. 1950, p. 63-65.

Methods developed for eight different types of induction and torch soldering operations on aircraft intake manifolds. Most difficult was the job of joining a drop-forged stainless-steel flange to an SAE 1010 20-gage gusset which was itself spot welded and silver soldered to a 20-gage Cr-Mo pipe. Change from torch to induction soldering resulted in major economies. (K7, CN, SS, AY)

152-K. Tanks Can Be Simple. J. J. Sloan. *Western Machinery and Steel World*, v. 41, Feb. 1950, p. 76-78.

Recommendations for tank design and welding fabrication. Emphasis is on the type of tank used to hold aircraft fuel. (K general, T26)

153-K. Practical Welding Metallurgy. E. W. P. Smith. *Industry & Welding*, v. 23, Mar. 1950, p. 32, 34-35.

Practical information for the nonmetallurgist who wants to know what causes trouble in welding some steels, and what can be done to overcome the trouble. (K9, ST)

154-K. Versatile Welding Fixture. *Industry & Welding*, v. 23, Mar. 1950, p. 70.

Fixture for inert-arc seam or spot welding of a wide range of sheet-metal thicknesses. (K1)

155-K. Joining Stainless to Chrome-Moly. T. B. Jefferson. *Welding Engineer*, v. 35, Mar. 1950, p. 27.

Method of joining turbine throttle valves of Type 347 stainless to Cr-Mo steel piping. The stainless has a 50% greater coefficient of expansion. It was necessary to use a "transition" piece of gradually varying composition. The "Kelcaloy" or electric-ingot process was used to cast a stainless steel section onto a Cr-Mo steel forging. (K general, AY, SS)

156-K. B: Preheat to 500 F. Fred M. Burt. *Welding Engineer*, v. 35, Mar. 1950, p. 28-30.

Prescription for welding high-Cr pump barrels: preheat and maintain the preheat temperature. Ingenious rotating fixtures for hard facing of sleeves and other parts. (K1, L24, AY)

157-K. If You Want To Make a Good Gas Weld—Watch Flame Adjustment. A. DiNardo. *Welding Engineer*, v. 35, Mar. 1950, p. 32-34.

Recommended procedures. SAE 1025 weld microstructures for neutral, carburizing, and oxidizing flames are illustrated. (K2, CN)

158-K. Bumps Avoided. Ira Carroll. *Welding Engineer*, v. 35, Mar. 1950, p. 35.

New streetcar rails turned out to be ¾ to 1 in. higher than adjoining older section. To avoid bumping, emergency build-up was made by arc welding. (K1, L24)

159-K. Fixtures Aid Welding of "American Kitchens" Cabinets. Walter Rudolph. *Welding Engineer*, v. 35, Mar. 1950, p. 36-37.

Resistance-welding equipment. (K3, T10)

160-K. Welded Machine to Process Meats. William C. Henzlik. *Welding Engineer*, v. 35, Mar. 1950, p. 38-40.

Steel meat-packing equipment made by various welding procedures. (K general, T29)

161-K. Riveted Framing Was Changed To Welded When Cost Comparisons Showed That Welded Building Frame Saved Money. *Engineering News-Record*, v. 144, Mar. 9, 1950, p. 31-33. (K general, T26, CN)

162-K. Adhesives for Metals. C. J. Moss. *Plastics Institute, Transactions*, v. 18, Jan. 1950, p. 64-67; discussion, p. 71-73. (K12)

163-K. New Metal Bonding Process; Various Applications in Industry. K. S. Meakin. *Metal Treatment and Drop Forging*, v. 16, Winter 1949-50, p. 225-228, 230.

Bonding by gluing and its advantages over joining by welding or soldering. Technique, using the "Redux" process; application in various industries. (K12)

164-K. Rubber as a Stress-Carrying Material and Some Design Considerations. S. W. Marsh. *Institution of Mechanical Engineers, Proceedings* (Automobile Div.), 1948-49, p. 25-31; discussion, p. 31-41.

Includes rubber-metal bonding and typical failures. (K11)

165-K. Cold Pressure Welding of Aluminium Cable Sheaths. *Engineering*, v. 169, Feb. 10, 1950, p. 150.

Welding equipment and procedure. (K5, Al)

166-K. Arc Welding in an Argon Atmosphere. (In French.) R. Arnaud. *Soudure et Techniques Connexes*, v. 3, Nov.-Dec. 1949, p. 259-267.

Methods for inert-gas arc welding, using gases such as argon or helium. Optimum conditions for the individual methods, and electrical circuits of apparatus. (K1)

167-K. Welding in the Construction of Modern Locomotives. (In German and French.) M. G. Borgeaud. *Zeitschrift für Schweisstechnik; Journal de la Soudure*, v. 39, Dec. 1949, p. 215-224; v. 40, Jan. 1950, p. 8-11.

Problems and methods of welding with due regard to stress conditions. (K general, T23)

168-K. Metallizing (Making Conductive) of Glass and Synthetics. (In German.) *Metalloberfläche*, sec. B, v. 2, Jan. 1950, p. 9-11.

Brief specifications for coating glass

and plastics with metal films by a number of different methods. (K11)

169-K. Structure and Properties of the Heat-Affected Zones of Welded Al-Cu-Mg Stampings. (In German.) H. Kostron and A. Müller-Busse. *Metall*, v. 4, Feb. 1950, p. 41-48.
Structure, hardness, and corrosion resistance of the heat-affected zones of aluminum alloy containing 4.07% Cu, 1.39% Mg, 0.96% Mn, 0.67% Si, and 0.52% Fe, after gas and arc welding. (K9, Al)

170-K. Welding Stainless Steel Pipe. Allen J. Ely, Jr. *Heating and Ventilating*, v. 47, Feb. 1950, p. 63-67; Mar. 1950, p. 70-72.
(K general, SS)

171-K. Controlling Welding Distortion. C. G. Bainbridge. *Canadian Metals*, v. 13, Feb. 1950, p. 41-44.
Main causes of welding distortion and practical methods for control. (K general)

172-K. Flush Head Screw Allowables in 24S-T Alclad Sheet Joints. Harold G. Brilmyer. *Product Engineering*, v. 21, Mar. 1950, p. 109-112.
Tests of shear-loaded lap joints to determine allowable shear and bearing loads for 100° steel screws in Alclad sheet. Allowables are set up for different sheet thicknesses. (K13, Al)

173-K. Assembly of Thin-Walled Parts by Rubber Crimping. Frank R. Simpson. *Product Engineering*, v. 21, Mar. 1950, p. 144-148.
How thin-walled metal parts can be assembled by crimping at high pressure, using rubber rings that are constrained on all sides except the working surface. Properly formulated and supported, rubber can transmit pressures in the order of 30,000 psi. The process gives tighter joints, with low residual stress. (K13)

174-K. A Survey of Modern Theory on Welding and Weldability. (Series continued.) D. Séférian. *Sheet Metal Industries*, v. 27, Mar. 1950, p. 241-253.
Various types of weld defects, their causes, and prevention. Destructive and nondestructive weld inspection methods. (Series to be continued.) (K9, S13)

175-K. Application of Mild-Steel Electrodes. F. R. Strate and R. I. Strough. *Welding Journal*, v. 29, Mar. 1950, p. 193-197.
Fundamental elements governing choice. (K1, T5, CN)

176-K. 1949 Adams Lecture: Fatigue of Structural Joints. Wilbur M. Wilson. *Welding Journal*, v. 29, Mar. 1950, p. 204-210.
Advantages and disadvantages of arc welding as a means of fabricating steel structures, importance of fatigue, and design considerations. (K1, Q7, CN)

177-K. The German Heating Electrode. *Welding Journal*, v. 29, Mar. 1950, p. 210.
Brief note gives compositions of core rod, slag, and metal occasionally deposited by a special electrode used only for local preheating and postheating, but not for deposition of weld metal. Original previously abstracted. See "The Heating Electrode, a New Means of Local Heat Treating and Heating", H. Schottky and F. H. Müller, *Schweissen und Schneiden*, item 18A-29, 1949. (K1, J1)

178-K. The Homopolar Generator for Resistance Welding. Thomas J. Crawford. *Welding Journal*, v. 29, Mar. 1950, p. 211-215.
Basic elements consist of a homopolar generator, a flywheel, a carbon-pile contactor, and a three-phase induction motor drive. Characteristics and advantages. Mechanical properties of ferrous and nonferrous welds. (K3)

179-K. Arc Welding in Railroad Shops. E. Di Liberti. *Welding Journal*, v. 29, Mar. 1950, p. 227-230.
(K1, T23)

180-K. How To Bronze Weld. C. H. Wanamaker. *Welding Journal*, v. 29, Mar. 1950, p. 235-237.
(K8)

181-K. Preliminary Results of Welding-Peening Investigation. J. Lyell Wilson. *Welding Journal*, v. 29, Mar. 1950, p. 97s-108s.
Peening is often used as an adjunct to the welding process to improve weld properties. Plans for a comprehensive investigation made to evaluate each of the many variables involved. New experimental equipment and details of calibration of several peening hammers. (K general, G23)

182-K. The High-Frequency Notch-Bend Test. Bela Ronay. *Welding Journal*, v. 29, Mar. 1950, p. 122s-125s.
An economical method for determining the applicable welding procedure for ferritic steels. (K9, ST)

183-K. Seam Welding Monel Metal to Steel. Ernest F. Nippes, Allan R. Pfluger, and Gerald M. Slaughter. *Welding Journal*, v. 29, Mar. 1950, p. 134s-140s.
Resistance seam welding of monel to low-carbon steel in the 0.062-in. gage. For the weld times investigated, fusion of both the monel and steel resulted in a heterogeneous weld nugget and led to porosity and cracking in the weld zone. To avoid this effect, seam welds were made with fusion occurring only in the monel. Optimum conditions for producing these "braze" type welds were established. The strengths of these welds exceeded those of seam welds of steel to steel. (K3, Ni, CN)

184-K. Strain-Aging of Arc Welds in Mild Steel. A. E. Flanigan, M. Kaufman, and E. M. Emery. *Welding Journal*, v. 29, Mar. 1950, p. 146s-160s.
Extensive investigation of the strain-aging characteristics of welds made with several types of modern covered electrodes. Certain aspects of the notch-bend test. 19 ref. (K1, Q5, CN)

185-K. Sheet Steel and Spun Aluminum Team Up With Stud-Weld Design To Make Petroleum Tank Vent Valves Convenient To Handle and Easy To Install. George Stewart. *Steel*, v. 126, Mar. 20, 1950, p. 83.
(K1, CN, Al)

186-K. Hidden-Arc Welding Applied in Car Building. G. R. Johnson. *Machinery* (American), v. 56, Mar. 1950, p. 143-145.
Welding procedures for railroad cars. (K1, T23, CN)

187-K. Welding Aluminum and Cast Iron Parts. H. E. Gannet. *Railway Mechanical and Electrical Engineer*, v. 124, Mar. 1950, p. 153-156.
Use of inert-gas shielded-arc welding for repair and reclamation of various cast-iron and Al railroad equipment, including diesel-locomotive parts. (K1, T23, Al, CI)

188-K. Repair of Locomotive Plate Frames by Metallic Arc Welding. *Engineering*, v. 169, Feb. 17, 1950, p. 177-179; *Engineer*, v. 189, Feb. 17, 1950, p. 221-223.
(K1, T23, CN)

189-K. Synthetic Resins; Applications in the Engineering Industries. C. J. Moss. *Metal Industry*, v. 76, Feb. 24, 1950, p. 143-146.
A few examples of use for joining of dissimilar materials—wood to metal, porcelain to metal, etc. (K11)

190-K. Structural Welding Design. (In German.) Th. Ricken. *Schweissen und Schneiden*, v. 2, Jan. 1950, p. 2-11.
(K general, T26)

191-K. A New Process for Hard-Soldering Bicycle Frames. (In German.) H. W. Grönegress. *Schweissen und Schneiden*, v. 2, Jan. 1950, p. 12-14.
The solder is inserted in the form of beads or strips after the frame is assembled. (K7, CN)

192-K. (Book) Welding Handbook. Ed. 3. 1650 pages. 1950. American Welding Society, 33 W. 39th St., New York 18, N. Y. $12 in U. S. and Canada; $13 elsewhere.
27 chapters are devoted to various welding processes and equipment. 13 chapters contain information on the ferrous and nonferrous metals commonly welded, including their general properties, how to weld them by the different processes and their uses by different industries. 11 chapters contain information on design, material, workmanship, and inspection requirements for industrial applications. Additional chapters are devoted to data for estimating costs, physics of welding, welding metallurgy, a dictionary of welding terms and definitions, general engineering tables for shop and office use and welding standards. (K general)

193-K. (Book) Electric Arc Welding Procedure and Practice. 544 pages. Hobart Trade School, Troy, Ohio. $3.
The procedure and practice of arc welding. Designed for both the student and the practicing welder; also useful to the executive. (K1)

L
CLEANING, COATING AND FINISHING

153-L. Ceramics at the Bureau of Standards. II. *American Ceramic Society Bulletin*, v. 29, Feb. 1950, p. 72-75.
Activities and facilities of the refractories and enameled metals sections. (L27)

154-L. Vinyl Coatings for the Metal Decorator, Part Three. (Concluded.) Joseph M. Perrone and Edward R. Lawson. *National Lithographer*, v. 57, Feb. 1950, p. 46-47, 71, 73.
Properties and performance of Vinylite resin VAGH, including effects of various modifiers. (L26)

155-L. Steel Grit Cleaning Department. Robert C. Sherwood. *Western Metals*, v. 8, Feb. 1950, p. 27-29.
Respective advantages of sand and steel grit for a specific job. (L10, ST)

156-L. Infrared Degreasing and Paint Baking. Paul H. Krupp. *Industrial Finishing*, v. 26, Feb. 1950, p. 20, 23-24, 26, 28.
Procedures and applications. (L12, L26)

157-L. Production Lithographing of Metal Products. Ray W. Fultz. *Industrial Finishing*, v. 26, Feb. 1950, p. 54-56, 58, 60, 62.
Mass-production of lithographed signs. Black plate of can-making quality is printed in seven colors on a special press. (L26)

158-L. A Method for the Electrolytic Polishing and Etching of Some Al-Ag Alloys, Commercial Purity Aluminum and Pure Magnesium. L. W. Larke and E. B. Wicks. *Metallurgia*, v. 41, Jan. 1950, p. 172-174.
Details of procedure. Same solution is used for the Al-rich Al-Ag alloys, Al, and Mg. (L13, Al, Mg)

159-L. Electrolytic Polishing of Metals by Means of an Alternating Current. (In Japanese.) Tadao Fukurol. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, May 1949, p. 10-11.

Suitable for Ni, Fe, steel, Al, W, Zn, Sn, Cu, brass, and Mo. Apparatus and data. (L13)

160-L. Research on Cu Plating To Prevent Carburization. (In Japanese.) Tadayoshi Inui. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, May 1949, p. 12-15.

The acid solution was found to be unsuitable but an alkaline solution containing 33 g. CuCN, 38 g. NaCN, 14 g. Na_2CO_3, and 0.3 g. $Na_2S_2O_5$ per liter of H_2O was found to be satisfactory. A minimum of 0.008 mm. plating thickness is necessary to prevent carburization of carbon and Ni-Cr-W steels. (L17, J28, CN, AY)

161-L. The Cementation of Boron on Iron and Steel by Electrolysis of Fused Borax. (In Japanese.) Masuo Kawakami and Noboru Komuro. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Aug. 1949, p. 15-19.

Experimental study of the process. Cementation occurred at temperatures as low as 800° C. Above 900° C., it increased exponentially with temperature. For 0.15% C steel, at 900° C. and 10 amp. per sq.dm. for 2 hr., thickness of layer was about 0.1 mm. and hardness approximately 1200 Vickers. W, Mo, or V retarded the process and C, Ti, Si, and W increased hardness of the layer. (L15, B, Fe)

162-L. Electrodeposition of Alloys. (In Japanese.) Masuo Kawakami and Mayumi Someno. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Aug. 1949, p. 19-21.

Fe-Ni alloys were obtained by electrolysis from a solution containing sulfates of the two metals and ammonium sulfate. Relations between compositions of solutions, temperatures, current densities, duration of electrolysis, and compositions of electrodeposited alloys were investigated. The deposits contained approximately 18% Ni. (L17)

163-L. How To Work Clad Materials. Wm. M. Stocker, Jr. *American Machinist*, v. 94, Feb. 6, 1950, p. 89-104.

Special report tells how clad metals are made and covers handling; cutting; welding; machining; hot working; shearing and punching; bending and rolling; drawing; spinning; heat treatment; finishing; and nondestructive testing. (L22)

164-L. Ford Production of Rear Axle Housings Highly Mechanized. *Industrial Heating*, v. 17, Feb. 1950, p. 216-220, 222, 224, 226, 228, 230, 351-352, 354, 356.

A series of cleaning, annealing, forming, and welding operations. (A4, T21)

165-L. Finishing of Truck Light Components at Columbus Metal Products, Inc. *Industrial Heating*, v. 17, Feb. 1950, p. 293-294, 296, 298. (L general)

166-L. Electrical Measurements on Metal Protective Paints. W. E. Shaw and D. L. Hawke. *Finish*, v. 7, Mar. 1950, p. 26-29, 73.

Previously abstracted from *Organic Finishing*. See item 7A-180, 1949. (L26)

167-L. Preventing Defects in Enamelling Holloware. (Conclusion.) **Grayware Defects.** F. A. Petersen. *Ceramic Industry*, v. 54, Mar. 1950, p. 55-56.

Several types of defects; causes and remedies. (L27)

168-L. Theory of Rate Processes as a Means of Studying Plating Reactions. Donald G. Rogers and Arthur A. Burr. *Journal of the Electrochemical Society*, v. 97, Mar. 1950, p. 92-98.

Suggestions based on equations adapted from the literature are made for a method of study of plating cells where current efficiency is less than 100%. Procedure involving current-voltage curves. Data for the plating of Cr from chromic acid show applicability of the equations and indicate the possibility of this method of study for irreversible cells. Effect of sulfate ratio was studied. (L17, Cr)

169-L. Antimony Plating. K. Gustaf Soderberg and H. L. Pinkerton. *Plating*, v. 37, Mar. 1950, p. 254-259.

Production of dull to brilliant Sb deposits on Cu or steel of any desired thickness from complex citrate baths. Ductility and luster. 15 ref. (L17, Sb)

170-L. Chromium Plating Large Stainless Steel Welded Assemblies. *Plating*, v. 37, Mar. 1950, p. 260-264.

Procedure used by Briggs Manufacturing Co., Detroit. (L17, Cr, SS)

171-L. Pickling and Pickling Inhibition. Alfred Douty. *Plating*, v. 37, Mar. 1950, p. 269-271.

Recent developments in the field of oxide and scale removal, with special attention to inhibitors in acid pickling solutions. Hydrogen embrittlement and blistering as affected by inhibitors. Emphasis is on pickling of steels. 15 ref. (L12, ST)

172-L. A Technical Information File for the Plater and Metal Finisher. William P. Foley. *Plating*, v. 37, Mar. 1950, p. 276-277.

Proposes a filing system for the literature in the field. (L general)

173-L. Power Brushing Speeds Bumper Production. *Iron Age*, v. 165, Mar. 9, 1950, p. 78. (L10, CN)

174-L. Practical Plating Problems; Open Discussion by E. T. S. Midlands Centre. *Metal Industry*, v. 76, Feb. 10, 1950, p. 106-108. (L17)

175-L. Anodizing: Electrolytes—Film Formation—Electropolishing. D. H. Napier and J. V. Westwood. *Metal Industry*, v. 76, Feb. 17, 1950, p. 123-126.

Need for a more scientific approach to the anodic processing of aluminum. Reviews the literature and discusses theories. 22 ref. (L19, Al)

176-L. Soft Grit Blasting; A Recent Development for Cleaning Metals. *Automobile Engineer*, v. 40, Feb. 1950, p. 75-76. (L10)

177-L. The Bullard-Dunn Electrolytic Descaling and Tinplating Process. *Wire Industry*, v. 17, Feb. 1950, p. 115. Reprinted from *Tin and Its Uses*, Oct. 1949.

Unique feature of the process described is that the descaling bath, consisting of dilute H_2SO_4, uses a tin salt as an inhibitor. (L13, L17, Sn)

178-L. A Contributor Discusses Inhibitor Practice. *Wire Industry*, v. 17, Feb. 1950, p. 165.

Action of chemical corrosion inhibitors as applied to pickling of steel, especially in the form of wire. (L12, ST)

179-L. The Electrodeposition of Tungsten. F. W. Salt. *Murex Limited Review*, v. 1, no. 5, 1949, p. 77-87.

Critically reviews previous work. 19 ref. (L17, W)

180-L. Practical Application of the Metal-Spraying Process. (In German.) (Concluded.) H. Reininger. *Metalloberfläche*, sec. A, v. 3, Sept. 1949, p. 173-176; Oct. 1949, p. 191-195; Nov. 1949, p. 207-211; Dec. 1949, p. 220-223.

Compares the corrosion-protective and heat resistant properties of steels spray-coated by English, German, and French methods; and the heat resistant properties of steels Al-coated by different methods. Oct.: Application to surfacing of dies for molding of rubber and plastic articles, also for production of artistic objects. Nov.: Production of bearings and use of metal spraying for making repairs. Dec.: Repair and hard-surfacing methods, also several special applications. 161 ref. (L23)

181-L. Concerning the Production of Thin Sheets Especially for Enameling. (In German.) Erich Schauff. *Metalloberfläche*, sec. A, v. 4, Jan. 1950, p. 10-13.

Types of steels suitable for the rolling of thin sheets, treatment of the rolled sheets, and special problems in the enameling of thin sheets. Recent advances made in production and treatment. (L27, F23, ST)

182-L. Pickling and Pickling Acids. (In German.) W. Savelsberg. *Metalloberfläche*, sec. B, v. 2, Jan. 1950, p. 12.

Pickling with H_2SO_4 prior to galvanizing is frequently unsatisfactory; recommends the use of a 10% solution of HCl, possibly plus 5% $FeCl_3$. (L12, ST)

183-L. A New Method for Protecting of Metals in Electrolytes Against Corrosion by Coating With Monomolecular Films of a Nobler Metal. (In German.) O. Erbacher, W. Herr, M. Ebert, and H. v. Babo. *Archiv für Metallkunde*, v. 3, Dec. 1949, p. 409-413.

Experiments on electrodeposition of Bi on Ni, Cu on Zn, and Cu on Fe show that a monomolecular film of a nobler metal is an effective protection for electrodes. The optimum thickness of the layer is indicated by the equilibrium between the electrochemical deposition of the nobler metal and its resolution in the electrolyte. Coating of Fe with Cu was found to be an excellent protection against its corrosion. 14 ref. (L17, Zn, Fe, Ni)

184-L. Defective Galvanic Coatings, Their Causes and Methods of Correction. (In German.) E. R. Thews. *Archiv für Metallkunde*, v. 3, Dec. 1949, p. 432-436.

The different defects, their causes, and corrective measures for articles plated with Ni, Cu, brass, and Cd. (L17, Ni, Cu, Cd)

185-L. Weld Hard Surfacing of Water Turbines. (In German.) A. Schmidt and H. Fauland. *Schweisstechnik*, v. 3, Nov. 1949, p. 121-128.

Repair of worn or corroded water turbines. Compositions of two types of welding rods; strength properties of welded parts. (L24, ST)

186-L. Concerning the Growth of Electrolytically Produced Porous Aluminum Oxide Films. (In German.) Heinz Wilsdorf. *Zeitschrift für angewandte Physik*, v. 2, Jan. 1950, p. 17-20.

The outer and inner-surfaces of the films were examined under the electron microscope. Micrographs and tabulated data show the effects of acid and time on structure. (L19, Al)

187-L. Weld Hard Surfacing With Deloro-Stellite Hard Metal. (In German.) W. Brandenburger. *Zeitschrift für Schweisstechnik; Journal de la Soudure*, v. 40, Jan. 1950, p. 11-18.

"Deloro-Stellite" is described as a metal with high heat, corrosion, and wear resistant properties. The welding method used. (L24)

188-L. Electrodeposition of Alloys of Phosphorus With Nickel or Cobalt. Abner Brenner, Dwight E. Couch, and Eugenia Kellogg Williams. *Journal of Research of the National Bureau of Standards*, v. 44, Jan. 1950, p. 109-122.

Previously abstracted from *Plating*, v. 37, Jan. 1950, p. 36-42; Feb. 1950, p. 161-164. See item 98-L, 1950. (L17, Co, Ni)

189-L. Production Clinic for Finishing Die Castings. *Die Castings*, v. 8, Mar. 1950, p. 41-44.
Modern control methods for bright-nickel baths and chromate coatings for Mg. 12 ref. (L17, L14, Ni, Mg)

190-L. Barrel Chrome Plating Small Die Cast Parts Cuts Finishing Costs. E. F. Berry. *Die Castings*, v. 8, Mar. 1950, p. 45-46, 69-70.
As applied to zinc. (L17, Cr, Zn)

191-L. Kaiser—New Name in Porcelain Enameling. *Better Enameling*, v. 21, Mar. 1950, p. 8-15.
Equipment and procedures of Kaiser Metal Products, Bristol, Pa., now producing sinks and bathtubs. (L27, CN)

192-L. Trouble Shootin'. John L. McLaughlin. *Better Enameling*, v. 21, Mar. 1950, p. 33.
The following porcelain-enameling defects, their causes and remedies: Handling scars, point marks, stone marks, and dusting. (L27)

193-L. Hardfacing Applications in the Steel Industry. J. J. Barry. *Welding Journal*, v. 29, Mar. 1950, p. 198-203.
Types of hard facing alloys, service conditions, applications, techniques and methods, and economics. (L24, ST, SG-m)

194-L. Portable Automatic Hard-Facing of Drill Pipe Tool Joints. J. G. Watson, Jr., and H. N. Keener. *World Oil*, v. 130, Mar. 1950, p. 94-95.
(L24, ST, SG-j)

195-L. Non-Metallic Lining Materials for Process Vessels in the Pulp and Paper Industry. Beaumont Thomas. *Corrosion*, v. 6, Mar. 1950, p. 82-88; discussion, p. 88.
Ceramic and inorganic lining materials. 27 ref. (L26, L27, T29)

196-L. Some Observations on Reactions of Enamel and Iron. Grant E. Miller and B. J. Sweo. *Journal of the American Ceramic Society*, v. 33, Mar. 1, 1950, p. 107-110.
Gas evolution was observed during heating of mixtures of powdered iron and finely divided enamel frits. Specific gravity of the resulting mass was taken as an index of degree of gas evolution. Data were obtained as a function of time of heating, temperature employed, material addition, and type of frit. Tests with Cu, Ni, Cr, and Mn were also conducted. 16 ref. (L27, Fe, Cu, Ni, Cr, Mn)

197-L. How Chrome-Plated Piston Rings Are Made. *SAE Journal*, v. 58, Mar. 1950, p. 67-68. Based on "Chrome-Plated Piston Rings—Design and Application", by Arthur M. Brenneke.
Procedures used by Perfect Circle Corp. (L17, T21, Cr)

198-L. Metal Finishing Developments of 1949. Adolph Bregman. *Iron Age*, v. 165, Mar. 16, 1950, p. 76-81.
Economic and technological developments, including chemical polishing, waste disposal, nonmetallic finishing, etc. (L general)

199-L. Equipment Corrosion Seen Curbed by New "Poly" Spraying Technic. W. B. DeLong. *Food Industries*, v. 22, Mar. 1950, p. 82-83, 181-182.
Use of flame-sprayed polyethylene coatings for prevention of corrosion of food and chemical processing equipment. (L26, T29)

200-L. Well-Planned Cleaning, Spray Painting, and Baking Setup Produces High-Quality Kitchen Cabinets. Ezra A. Blount. *Products Finishing*, v. 14, Mar. 1950, p. 14-23.
Equipment and procedures. (L26)

201-L. New Seal Primer for Aircraft Finishing. Gilbert C. Close. *Products Finishing*, v. 14, Mar. 1950, p. 44-45, 48, 50, 52.
See abstract of "Priming Coat for Light Metals", *Light Metal Age*, item 6-L, 1950. (L14, Al, Mg)

202-L. Infra-Red Accomplishes Degreasing and Paint Baking on Single Conveyor. *Products Finishing*, v. 14, Mar. 1950, p. 82-86.
(L26)

203-L. A Report on Recent Research in Electrolytic Polishing. (Continued.) P. Michel. *Sheet Metal Industries*, v. 27, Feb. 1950, p. 165-173.
Methods for study of the microstructure of electropolished surfaces; and for measurement of their physical and mechanical properties, and corrosion resistance. General conclusions; present and potential applications. (L13)

204-L. The Production of Geometrically Accurate Shapes by Electrolytic Polishing. P. Michel. *Sheet Metal Industries*, v. 27, Mar. 1950, p. 267-271.
Causes of irregular polishing, design of anode and cathode assemblies, and effects of electropolishing on coefficient of friction and fatigue limit. Experiments on a component of simple geometrical form (a piston pin). (L13, ST)

205-L. Electroplating Jigs; Some Considerations of the Use of Permanent Magnets. A. H. E. Barrow. *Metal Industry*, v. 76, Feb. 24, 1950, p. 147-148.
Some ways in which permanent magnets can be utilized in electroplating jigs. (L17, T5, SG-n)

206-L. Batch Production Bright Nickel and Chrome Plating. R. Wall. *Journal of the Electrodepositors' Technical Society*, v. 25, 1950, p. 23-38. (Preprint.)
Workshop experiences, production methods, resulting finish, production costs, advantages, and disadvantages of one company's process. (L17, Ni, Cr)

207-L. Mechanism of Electrolyte Oxidation and of Formation of Aluminum Oxide Layers. (In French.) *Revue de l'Aluminium*, v. 26, Dec. 1949, p. 397-403.
Mechanism of formation of the layer; experimental method for study of the phenomenon; and results of a study of two cases: Formation of a very compact and highly insulating oxide layer; and formation of more or less porous layers of considerable thickness. (To be continued.) (L19, Al)

208-L. Protection of Metals by Diffusion of Chromium. (In French.) Philippe Galmiche. *Comptes Rendus* (France), v. 230, Jan. 2, 1950, p. 89-91.
Method by which, in a single operation, smooth bright coatings are obtained, also alloy coatings of Cr plus elements such as Al, Si, or Zr. (L15, Cr)

209-L. Electrical Resistance and Optimum Composition for Electropolishing Baths. (In French.) Eugène Darmois, Israël Epelboin, and Djafar Amine. *Comptes Rendus* (France), v. 230, Jan. 23, 1950, p. 386-388.
Method for study of optimum bath conditions by determination of electrical resistance of the solutions simultaneously with maximum resistance of the anodic layer. (L13)

210-L. Influencing the Electrical Deposition of Metals by Means of Cathodes Vibrating at Different Frequencies, Especially in the Range of Ultrasonic Frequencies. (In German.) Fr. Müller and H. Kuss. *Helvetica Chimica Acta*, v. 33, Feb. 1, 1950, p. 217-228.
Surveys literature on the above. Experiments on Cu, Ni, and Cr electrodeposits show that the method improves the adhesiveness, hardness, and tensile strength of the metal deposits and increases the current yield. (L17, Cu, Ni, Cr)

M
METALLOGRAPHY, CONSTITUTION AND PRIMARY STRUCTURES

79-M. X-Ray Diffraction Patterns Measured by "Photomicrometer". *Steel*, v. 126, Feb. 27, 1950, p. 64-65.
See abstract from *Review of Scientific Instruments*, item 39-M, 1950. (M22)

80-M. Fundamentals of the Working of Metals. Part VIII. Ingot Structure and Working. George Sachs. *Modern Industrial Press*, v. 12, Feb. 1950, p. 6, 8, 44.
Grain structures, segregations, and inclusions, as cast and after working, are diagrammed and discussed. (M27, Q24)

81-M. The Structure of Atoms From Diffraction Studies. H. Hauptman and J. Karle. *Physical Review*, ser. 2, v. 77, Feb. 15, 1950, p. 491-499.
Method for obtaining electron distribution in atoms from diffraction data. 15 ref. (M25, M22)

82-M. The Alloy Systems Uranium-Tungsten, Uranium-Tantalum and Tungsten-Tantalum. C. H. Schramm, P. Gordon, and A. R. Kaufmann. *U. S. Atomic Energy Commission*, AECD-2686, Aug. 26, 1949, 30 pages.
Previously abstracted from *Journal of Metals; Transactions of the American Institute of Mining and Metallurgical Engineers.* See item 15-M, 1950. (M24, U, Ta, W)

83-M. The Crystal Structure of UBi. Leo Brewer, Russell K. Edwards, and David H. Templeton. *U. S. Atomic Energy Commission*, AECD-2730, Aug. 31, 1949, 7 pages.
Preparation of suitable samples for X-ray investigation. Shows that UBi has a NaCl structure. (M26, U, Bi)

84-M. Metallography in Color. R. P. Loveland. "Symposium on Metallography in Color," *American Society for Testing Materials*, Special Technical Publication No. 86, June 21, 1949, p. 2-22.
Processes for making photographs. Integral tripack processes, illumination, color-compensation filters, exposure, and application to metallography. 11 ref. (M21)

85-M. Microscope Optics for Color Metallography. James R. Benford. "Symposium on Metallography in Color", *American Society for Testing Materials*, Special Technical Publication No. 86, June 21, 1949, p. 23-27; discussion, p. 28-29.
Experimental means used to evaluate optical designs, and the influence of color work on the design program. (M21)

86-M. Quality and Quantity of Illumination in Color Metallography. R. P. Loveland. "Symposium on Metallography in Color", *American Society for Testing Materials*, Special Technical Publication No. 86, June 21, 1949, p. 30-47; discussion, p. 48-50.
Utilization of color metallography and advantages in photomicrography, quantitative analysis criteria, exposure, and quality of illumination. Appendixes describe use of hand exposure meter and calibration of the amplification-type electronic photometer. (M21)

87-M. Color Metallography Simplified. Mason Clogg, Jr. "Symposium on Metallography in Color", *American Society for Testing Materials*, Special Technical Publication No. 86, June 21, 1949, p. 51-53.

Method of making color photomicrographs with the aid of a light-correction meter and a special set of light correction disks. (M21)

88-M. Some Applications of Color Metallography. W. D. Forgeng. "Symposium on Metallography in Color", *American Society for Testing Materials*, Special Technical Publication No. 86, June 21, 1949, p. 54-58.

General discussion followed by discussion of carbide constituents in tool metals; the σ-phase, Fe-Cr in Fe-Cr and Fe-Cr-Ni alloys; and color micrography with polarized light. (M21)

89-M. Progress in the Theory of Alloys. G. V. Raynor. "Progress in Metal Physics" (Interscience Publishers, New York), v. 1, 1949, p. 1-76.

Primary solid solutions, electron compounds, the electronic theory, intermediate phases, behavior of transition metals in Al alloys, and lattice spacings. 113 ref. (M26)

90-M. Theory of Dislocations. A. H. Cottrell. "Progress in Metal Physics" (Interscience Publishers, New York), v. 1, 1949, p. 77-126.

Mechanics of the atomic movements involved in plastic deformation. Types, properties, interaction, assemblies, and origin of dislocations. Structural strain hardening, aging and annealing worked metals, flexible dislocations, and precipitation hardening. 76 ref. (M26, Q24, N7)

91-M. Crystal Boundaries. R. King and Bruce Chalmers. "Progress in Metal Physics" (Interscience Publishers, New York), v. 1, 1949, p. 127-162.

Reviews recent experimental and theoretical work. Origin, mechanical properties, chemical behavior, and effects of boundaries. 53 ref. (M26)

92-M. Taper Sectioning; A Method for the Examination of Metal Surfaces. E. Rabinowicz. *Metal Industry*, v. 76, Feb. 3, 1950, p. 83-86. (M21)

93-M. Metallographic Studies on Complex Light Alloys. I. (In Japanese.) Takuiti Morinaga, *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, June 1949, p. 11-15.

Results of determination of aging behavior, corrosion resistance, grain size, and effect of heat treatment on structure indicate that the τ-phase is formed during coexistence of Mn and Si. (M27, Al)

94-M. The Application of Color Photography to the Study of Nonmetallic Inclusions. A. M. Hall and E. E. Fletcher. "Symposium on Metallography in Color", *American Society for Testing Materials*, Special Technical Publication No. 86, June 21, 1949, p. 59-63; discussion, p. 64.

13 references. (M21)

95-M. The Uranium-Manganese and Uranium-Copper Alloy Systems. H. A. Wilhelm and O. N. Carlson. *U. S. Atomic Energy Commission*, AECD-2717, Aug. 15, 1949, 17 pages.

Investigated by thermal, microscopic, and X-ray methods. Compounds identified. (M24, U, Mn, Cu)

96-M. The Study of Alloy Systems; Chemical Extraction Method for Constitutional Investigations. *Metal Industry*, v. 76, Feb. 10, 1950, p. 103-105.

Details of technique. A slowly cooled ingot is prepared, sectioned, and examined micrographically. If this examination reveals the intermediate phases present to be free from rims or inclusions, another portion is made the anode in an electrolytic cell, with a nickel strip as cathode. The residue obtained is washed and dried, examined under a low-power binocular microscope, and perfect crystals isolated. Illustrated by phases from the Al-Mn-Zn (9-90% Zn; 0-5% Mn) and Al-Fe-Si systems. (M23, Al, Zn)

97-M. Metallic Segregation in Ferritic Steels; An Application of Microradiography. K. J. B. Wolfe and I. R. Robinson. *Metal Treatment and Drop Forging*, v. 16, Winter 1949-50, p. 209-218.

Fundamentals of microradiography, including use of both "white" and characteristic radiation, and details of suitable apparatus and techniques. The absorption edge method is used to demonstrate the presence of segregations of Mn, Cr, and W. The quantity of Mn segregations present is reduced by a small Mo content in the steel. 14 ref. (M23, AY)

98-M. Electron Microscopy in Metallurgy; Techniques and Applications to Study of Metals. *Metal Treatment and Drop Forging*, v. 16, Winter 1949-50, p. 247-251.

Reviews proceedings of recent London symposium sponsored by the Institute of Metals and other societies. (M21)

99-M. The Manganese-Germanium System. (In German.) Ulrich Zwicker, Eduard Jahn, and Konrad Schubert. *Zeitschrift für Metallkunde*, v. 40, Dec. 1949, p. 433-436.

Experiments made to determine the Mn-Ge constitution diagram, to study the metallographic and X-ray structures of the alloys in this system, and to determine their magnetic and other physical properties. (M24, P general, Mn, Ge)

100-M. The Ternary Indium-Tin-Cadmium System. (In German.) Erich Gebhardt. *Zeitschrift für Metallkunde*, v. 40, Dec. 1949, p. 437-440.

Method of experimentation and brief review of work done on the In-Sn, Sn-Cd, and Cd-In systems. The eutectic of the In-Sn-Cd system was established at 93° C. and its composition was found to be 44% In, 42% Sn, and 14% Cd. Constitution diagrams and cooling curves. (M24, In, Sn, Cd)

101-M. Research on the Structure of Metals With the Aid of "Electrolytic Spot Etching". Development of a Practical Instrument for Continuous Structure Control as a Substitute for the Time-Consuming Preparation of Polished Samples. (In German.) G. Stähli and W. Rüegg. *Schweizer Archiv für angewandte Wissenschaft und Technik*, v. 16, Jan. 1950, p. 25-27.

Proposed equipment makes it possible to prepare a sample for metallographic examination in 20-30 sec. (M21)

102-M. The Binary Systems of Titanium With the Elements Nitrogen, Carbon, Boron, and Beryllium. (In German.) Paul Ehrlich. *Zeitschrift für anorganische Chemie*, v. 259, July 1949, p. 1-41.

The nitrides, carbides, borides, and Be alloys of Ti were prepared by powder metallurgy under high vacuum, and the products were studied by X-ray and pyknometric methods. Results show great similarity of the four systems. 71 ref. (M24, Ti)

103-M. Metal Amides and Metal Nitrides. Report 20. The Iron-Nickel-Nitrogen System. (In German.) Harry Hahn and Heinz Mühlberg. *Zeitschrift für anorganische Chemie*, v. 259, July 1949, p. 121-134.

Fe-Ni alloys ranging in iron content from 10 to 95 atomic % Fe were "nitrided" in a stream of NH_3 at 300-1000° C. Results show that N_2 absorption of the alloys increases linearly with Fe content. However, the maximum N_2 absorption can be increased by heat treating and quenching from 600-800° C. before nitriding at 400-500° C. Various phases of the resulting alloys were studied by X-ray diffraction. 17 ref. (M27, Fe, Ni)

104-M. The Crystal Structures of Ga_2S_3, Ga_2Se_3, and Ga_2Te_3. (In German.) Harry Hahn and Wilhelm Klingler. *Zeitschrift für anorganische Chemie*, v. 259, July 1949, p. 135-142.

Determined from Debye-Scherrer patterns. Surveys compounds having the structure of wurtzite or zinc blende. (M26, Ga, Se, Te)

105-M. Metal Amides and Metal Nitrides. Report 21. Solid Solutions of the Composition $(Li,Co)_3N$, $(Li,Ni)_3N$, and $(Li,Cu)_3N$. (In German.) Werner Sachsze and Robert Juza. *Zeitschrift für anorganische Chemie*, v. 259, Sept. 1949, p. 278-290.

The nitrogen absorption of Co, Ni, and Cu when heated with lithium nitride at 600, 560, and 620° C., respectively, was determined. X-ray studies indicate that the resulting products are solid solutions. 12 ref. (M27, Li, Ni, Co, Cu)

106-M. Determining Irregular Lattice Distortions. (In German.) R. Fricke and A. Seitz. *Zeitschrift für anorganische Chemie*, v. 259, Sept. 1949, p. 303-304.

A new method for the above, using a counting tube for measuring the intensities. Several examples are presented. (M26)

107-M. Investigation of the Constitution Diagram of the System Al-Cu-Mg-Si. (In Russian.) D. A. Petrov and N. D. Nagorskaya. *Zhurnal Obshchei Khimii* (Journal of General Chemistry), v. 19(81), Nov. 1949, p. 1994-2037.

On the basis of data obtained by physico-chemical analysis of nine linear cross sections of the above system, a tetrahedral diagram was prepared. 13 ref. (M24, Al, Cu, Mg, Si)

108-M. Determination of the Depth of Penetration of the Martensite Zone in Tempered Steel by a Magnetic Method. (In Russian.) M. V. Dekhtyar. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, Dec. 1949, p. 1397-1407.

Experimental verification of a method for calculation of the coercive force of a heterogeneous two-layered cylinder, based on the assumption that the coercive force of such a ferromagnetic body is not entirely characterized by the material, but is dependent on the relationship between the cross section of the core and the shell. Based on this principle, a method is developed for the above. 20 ref. (M23, N8, ST)

109-M. The Constitution of Alloys. R. L. Cunningham. *Canadian Metals*, v. 13, Feb. 1950, p. 10-13, 49.

What phase diagrams are and how they can be applied in the metal industry. (M24)

110-M. Welding Metallurgy—Iron and Steel. Chapter 7. Effects of Alloying Elements. O. H. Henry, G. E. Claussen, and G. E. Linnert. *Welding Journal*, v. 29, Mar. 1950, p. 216-226. Reprinted from second edition of book.

Solubility, equilibrium diagrams, effects on mechanical and physical properties in general, and effects of specific alloying elements in iron, aluminum, and copper. (M24, Q general, Fe, Al, Cu)

111-M. Thorium-Carbon System. H. A. Wilhelm and P. Chiotti. *U. S. Atomic Energy Commission*, AECD-2718, Sept. 30, 1949, 14 pages.

Constitution diagram constructed from metallographic, X-ray, and melting data. 12 ref. (M24, Th)

112-M. The Crystal Structures of CeB_6, ThB_6, and UB_6. Allan Zalkin and D. H. Templeton. *U. S. Atomic Energy Commission*, AECD-2762, Nov. 22, 1949, 2 pages.

(M26, Ce, Th, U)

113-M. Constitution Diagram and Phase Transformations in the Iron-

Nitrogen System. (In Russian.) I. N. Kontorovich and A. A. Sovalova. *Izvestiya Akademii Nauk SSSR* (Bulletin of the Academy of Sciences of the USSR), Section of Technical Sciences, Nov. 1949, p. 1675-1684.

Investigated with emphasis on phase transformations at nitrogen concentrations above 2.5-3.0% at temperatures above the eutectoid (591° C.). Data indicate that, of two constitution diagrams currently in use, the diagram with a peritectoid transformation is erroneous. Methods of investigation by X-ray diffraction and metallographic study. Microhardness of different structural components of nitrided layers was determined. (M24, N8, Fe)

114-M. (Book) **Symposium on Metallography in Color.** 64 pages. 1948. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Special Technical Publication No. 86. Cloth bound, $5.15; paper bound, $4.50.

Papers (abstracted separately) on microscope optics, quality and quantity of illumination, and applications. Includes 8 pages of color insert plates. 33 ref. (M21)

115-M. (Book) **Introduction to Crystallography.** (In German.) H. Schneiderhohn. 464 pages. Verlag Karl Alber, Freiburg in Breisgau, Germany. 40 marks.

History of crystallography, its geometric, chemical, and physical aspects. (M26)

116-M. (Book) **Metallography of Magnesium and Its Technical Alloys. Ed. 2.** (In German.) W. Bulian and E. Fahrenhorst. 100 pages. 1949. Springer-Verlag, Berlin, Germany.

One of a series of monographs on pure and applied metallography. 250 illustrations, including many photomicrographs. Sections dealing with alloys are limited almost entirely to the Mg-Mn and Mg-Al-Zn groups. (M21, M27, Mg)

N

TRANSFORMATIONS AND RESULTING STRUCTURES

46-N. Age Hardening of Metals. G. C. Smith. "Progress in Metal Physics" (Interscience Publishers, New York), v. 1, 1949, p. 163-234.

Theory of the above process, tracing its development since the earliest work. 63 ref. (N7)

47-N. Hardening Response of Steels. E. H. Bucknall and W. Steven. "Progress in Metal Physics" (Interscience Publishers, New York), v. 1, 1949, p. 235-280.

Reviews recent investigations of hardening depth and transformation mechanism of carbon and alloy steels. Effects on mechanical properties. 95 ref.
(N8, Q general, CN, AY)

48-N. Preferred Orientation in Non-Ferrous Metals. T. Ll. Richards. "Progress in Metal Physics" (Interscience Publishers, New York), v. 1, 1949, p. 281-305.

General discussion of orientation of crystals with special attention to the influence of cold rolling and annealing on the structure and properties of copper and brass strip. 37 ref. (N5, Cu)

49-N. Diffusion of Metals in Metals. A. D. Le Claire. "Progress in Metal Physics" (Interscience Publishers, New York), v. 1, 1949, p. 306-379.

A phenomenological theory in terms of which diffusion coefficient measurements should be made. Experimental methods used, important results and conclusions drawn from them. 132 ref. (N1)

50-N. Investigations Into Corrosion Resisting Cast Chromium-Nickel Steel With Special Reference to the Sigma Phase. *Metallurgia*, v. 41, Jan. 1950, p. 163-164. From *Sulzer Technical Rev.*, 1949, no. 2, p. 1-8.

Influence of heat treatment on the formation of sigma phase for Type 20-14-4 (AISI 317). (N8, SS)

51-N. Decarburized Structures of White Cast Irons. (In Japanese.) Tokuhiko Mochida. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, May 1949, p. 24-26.

Cast irons containing 2.5 to 4.7% C were decarburized with H_2 at 750-850° C. Photomicrographs show structures obtained. (N8, CI)

52-N. Concerning the Mechanism of Formation of "Lower Bainite" and Troostite in Steels. (In Japanese.) Zenji Nishiyama and Michiyasu Doi. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, June 1949, p. 3-8.

Theoretical discussion. (N8, ST)

53-N. Graphitization of White Cast Iron. (In Japanese.) Kyuya Nagasaki. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, June 1949, p. 15-18.

Theoretical explanation based on the assumption that the process consists of diffusion of carbon in the matrix iron from cementite to graphite and that an Fe-graphite alloy is present. (N8, CI)

54-N. Concerning Superlattice Structures in the Mg-Cd System. (In Japanese.) I. Seizo Nagasaki, Makoto Hirabayashi, and Hideo Nagasi. II. Makoto Hirabayashi, Seizo Nagasaki, Hideyo Maniwa, and Hideo Nagasu. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, July 1949, p. 1-10.

Part I: Some physical properties of superlattices corresponding to Mg_3Cd, MgCd, and $MgCd_3$ and their relationships to the order-disorder transformation and temperature. Part II: A general review of the system based on study of about 40 specimens of various compositions. 16 ref. (N10, Mg, Cd)

55-N. Absorption of Gases by Metals. (In Japanese.) Shoichi Matsuda. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, July 1949, p. 10-14.

Statistical mechanical treatment of the problem assuming that the amount of gas absorption depends on the geometrical arrangement of the gas particles in the metal. The method of superlattice formation in binary alloys is applied to the problem. An experiment on activated absorption of O_2 by Ag suggests the validity of the arguments.
(N15, N10)

56-N. Formation of Columnar Austenite Grains by Carburization of α-Iron. (In Japanese.) Tokuhiko Mochida. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, July 1949, p. 34-35.

Results of laboratory investigation. Includes diagram of apparatus and photomicrographs. (N8, Fe)

57-N. Influence of Carbon and Silicon on the Graphitization of White Cast Iron. (In Japanese.) Tokuhiko Mochida. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, July 1949, p. 36-38.
(N8, CI)

58-N. The Ar_1 Transformation. I-II. (In Japanese.) Kyuya Nagasaki. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Aug. 1949, p. 1-7.

The initial temperatures of precipitation of α-phase or Fe_3C from austenite are shown to be represented by "supersolubility" curves G_3S_3 and E_3S_3, respectively, and not by solubility curves. The idea of supersolubility curves is applied to explain the mechanism of the above transformation. Part II: Austempering mechanisms and their structures. 10 ref. (N8, Fe)

59-N. Residual Stress Restored in Carburized and Decarburized Steels Slowly Cooled and Quenched. VI. Residual Stress Measurement. (In Japanese.) Tadao Sano. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Aug. 1949, p. 21-25.

Some residual-stress vs. depth curves of heat treated steels are smooth while others show minima. The latter are attributed to the unequal temperature of the Ar_1, Ar′ or Ar″ transformation in the specimen when its dimensions are large, or when its composition is not uniform because of decarburization or carburization. (N8, Q25, ST)

60-N. The Rate of Diffusion of Oxygen Through Silver on Silver-Plated Copper Wires. (In German.) Karl Hauffe. *Zeitschrift für anorganische Chemie*, v. 257, Dec. 1948, p. 279-288.

Studied at 700 and 610° C. and at an oxygen pressure of 1 atm. Results are compared with those obtained by other investigators. 15 ref. (N1, Ag, Cu)

61-N. Studies on the Structure of Hard Chromium Plate. Cloyd A. Snavely and Charles L. Faust. *Journal of the Electrochemical Society*, v. 97, Mar. 1950, p. 99-108.

Structural changes which take place during annealing of Cr plate, illustrated by photomicrographs. Recrystallization can be effected between 300 and 500° F. Loss of hardness is concurrent with recrystallization. Results of hydrogen-extraction tests up to 650° C. X-ray and electron-diffraction studies show that heating to above the temperature range at which the plate softens does not destroy the normal preferred orientation. (N5, Cr)

62-N. An Approximate Theory of Order in Alloys. J. M. Cowley. *Physical Review*, ser. 2, v. 77, Mar. 1, 1950, p. 669-675.

Values of long and short-range order parameters obtained by solving the equations developed are in good agreement with experimental values found by X-ray diffraction methods. The theory is extended to calculation of configurational energy and specific heat, and to determination of order parameters for alloys of arbitrary composition in such binary systems as the Cu-Au alloys. 14 ref. (N10)

63-N. Modern Metallurgy of Cast Iron. H. Morrogh. *Engineering*, v. 169, Feb. 3, 1950, p. 136-138; Feb. 10, 1950, p. 166. A condensation.

Microstructures and transformations. Use of various elements to promote formation of nodular graphite. (To be continued.)
(N8, E25, CI)

64-N. Concerning the Structure of Primary Solutions of Binary Alloys. (In French.) Léon Jollivet. *Comptes Rendus* (France), v. 229, Dec. 14, 1949, p. 1330-1332.

Applies the laws of solid-liquid equilibrium. Results of experimental investigation of solutions of Zn in Ag and of Sn in Pb agree with theoretical conclusions. (N12, Ag, Pb)

65-N. Thermomagnetic Study of Cementite Stability. (In French.) A. Michel and R. Bernier. *Revue de Métallurgie*, v. 46, Dec. 1949, p. 821-823; discussion, p. 823-824.

Experimental data indicate that the physicochemical properties of cementite may best be determined from study of kinetics of graphitization; and influence of substitution of Fe atoms by Mn, Ni, Cr, etc., and of C atoms by the "metalloids" Si, Ti, B, N, etc. (N8, ST)

66-N. Equilibrium Disturbances in the γ-α Transformation of Iron Caused by Insufficient Diffusion. (In German.) A. Wüstefeld. *Archiv für Metallkunde*, v. 3, Dec. 1949, p. 436-438.

Attempts to explain the embrittlement of sheets of ingot iron which occurs whenever its structure contains ferrite "envelopes" as the result of insufficient diffusion in the γ-phase. Experiments show that a steel may lose its resistance to age hardening by being heat treated above the A_3 transformation point. Conversely, it is frequently possible to impart resistance to age hardening by cold working and then heating for an extended time below the transformation temperature. (N8, Fe, ST)

67-N. Explanation of the Effect of Pressure on the Basis of Anisotropic Cold Age-Hardening. (In German.) Hugo Josef Seemann. *Zeitschrift für Metallkunde*, v. 40, Dec. 1949, p. 441-445.

Study of the effect of extension of Al alloys makes it possible to observe the natural age hardening process with changing structure of the nonrecrystallized alloy, since the "pressure effect" becomes evident only as the alloy age hardens at room temperature. Experiments with annealed extended bars show that this effect can be eliminated by age hardening at elevated temperatures. 13 ref. (N7, Al)

68-N. The Structure of Graphite. (In German.) *Neue Giesserei*, v. 37 (new ser., v. 3), Jan. 1, 1950, p. 9.

Methods of determining the three-dimensional structures of graphite in cast-iron. (N8, CI)

69-N. Atomic Magnetic Moments of Transition Metals and Alloys and Interatomic Distances in Their Crystalline Lattices. I. Atomic Magnetic Moments and Interatomic Distances. (In Russian.) F. M. Gal'perin. *Izvestiya Akademii Nauk SSSR* (Bulletin of the Academy of Sciences of the USSR), Physical Series, v. 13, Sept.-Oct. 1949, p. 574-595.

Results of experimental and theoretical investigation are in agreement with existing data, and indicate that a relation exists between atomic magnetic moments of transition metals and alloys and interatomic spaces in their crystalline lattices, and also types of the latter. 26 ref. (N11)

70-N. Mechanism of Combustion of Iron. (In Russian.) A. L. Veis and A. I. Rozlovskii. *Zhurnal Fizicheskoi Khimii* (Journal of Physical Chemistry), v. 23, Nov. 1949, p. 1305-1310.

Investigation of combustion in a stream of oxygen led to the conclusion that oxygen diffuses through the oxide layer. This diffusion mechanism permits qualitative explanation of the mechanism of oxygen cutting. 12 ref. (N1, G22, Fe)

71-N. Two Types of Grain Boundary Migration in High-Purity Aluminum. Paul A. Beck and Philip R. Sperry. *Journal of Metals*, v. 188, Mar. 1950, p. 468A.

Application of a new technique for studying migration in Al which allows clear distinction between the two types. (N3, Al)

72-N. Diffusion Coefficient of Carbon in Austenite. Cyril Wells, Walter Batz, and Robert F. Mehl. *Journal of Metals; Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 188, Mar. 1950, p. 553-560.

Values covering a wide range of temperature and composition were determined by statistical methods. The relation between concentration and diffusion coefficient, activation heat of diffusion, and the constant in the diffusion equation were obtained. (N1, ST)

73-N. Carbides in Long-Tempered Vanadium Steels. Walter Crafts and John L. Lamont. *Journal of Metals; Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 188, Mar. 1950, p. 561-574.

Carbides in V-Cr-Mo steels were studied with the electron microscope after tempering up to 1000 hr. at 600-1400° F. It was found that alloy carbides are formed at the secondary hardening temperature by decomposition of the plate-like iron carbides and that vanadium carbide persists as much smaller particles than do Cr or Mo carbides. Conditions conducive to the formation of fine vanadium carbides are favorable for high temperature strength. (N8, AY)

74-N. A Study of Recrystallization and Grain Growth by Measurements of Internal Friction. T'ing-Sui Ke. *Journal of Metals; Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 188, Mar. 1950, p. 581-585.

Study on Al, Cu, and Fe. Effect of complete recrystallization temperature, annealing time, previous cold work, and impurities. Method gives results in agreement with those of metallographic examinations. (N5, Q22, Al, Cu, Fe)

75-N. The Effect of Thermal Cycles on the Structure of Alloys: Diffusion Effects in Two-Phase Alloys. R. J. Davis and W. Hume-Rothery. *Proceedings of the Royal Society*, ser. A, v. 200, Feb. 22, 1950, p. 441-458.

A qualitative examination was made of a simplified two-phase system consisting of a single spherical particle embedded in an isotropic matrix in which the solubility of the particle phase varied with temperature. Shows that under continual cycles of temperature the particle will be surrounded by a "zone of influence" in which concentration varies with the period of the cycle, and outside which a steady state is set up where concentration is intermediate between equilibrium values at the two extremes of temperature. Magnitude of the zone of influence is calculated for various cases. 12 ref. (N1)

76-N. Thermo-Elastic Analysis of Allotropic Transformations of Steels. (In French.) Georges Vidal and Pierre Lescop. *Comptes Rendus* (France), v. 230, Jan. 9, 1950, p. 206-208.

Investigated on the basis of variations of Young's modulus in carbon steels (0.65 and 0.9% C) and alloy steel (0.38% C, 3.7% Ni, and 1.5% Cr) using the apparatus of Florisson (determining the speed of sound in metals at a temperature θ). (N6, CN, AY)

77-N. Role of Hydrogen in the Formation of Flakes. (In Russian.) N. A. Galaktinova. *Izvestiya Akademii Nauk SSSR* (Bulletin of the Academy of Sciences of the USSR), Section of Technical Sciences, Nov. 1949, p. 1666-1674.

A series of experiments made to clarify the status of H_2 in steel and its role in the formation of flakes. Results indicate that enrichment of the metal with H_2 essentially changes its characteristics: it acquires a silver-white color and becomes resistant to corrosion under normal conditions. Method of investigation, using a high-frequency vacuum furnace. 11 ref. (N15, ST)

78-N. (Book) **Progress in Metal Physics. Vol. I.** Bruce Chalmers, editor. 401 pages. 1949. Interscience Publishers, 215 Fourth Ave., New York 3, N. Y. $9.50.

Various authors review progress in theory of alloys, theory of dislocations, crystal boundaries, age hardening, hardening response of steels, orientation in nonferrous metals, and diffusion of metals in metals. Individual contributions are abstracted separately. 569 ref. (N general)

P

PHYSICAL PROPERTIES AND TEST METHODS

80-P. Permanent Magnet Association; Central Research Laboratory. K. Hoselitz. *Research*, v. 3, Feb. 1950, p. 77-82.

Physical and metallurgical considerations in permanent-magnet materials, and results of some experimental work. 10 ref. (P16, SG-n)

81-P. Effects of Subatmospheric Temperatures on the Properties of Non-Ferrous Metals. Norman L. Mochel. "Symposium on Effects of Low Temperatures on the Properties of Materials", *American Society for Testing Materials*, Special Technical Publication No. 78, 1946, p. 47-49; discussion, p. 50.

Review of several references, particularly in connection with high-temperature alloys. (P general, Q general, EG-a, SG-h)

82-P. Concerning the Ferromagnetic Behavior of Nickel-Cobalt Alloys. II. (In Japanese.) Mikio Yamamoto. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, July 1949, p. 15-22.

Magnetization curves for fields up to 900 oersteds were measured at room temperature for about 60 annealed Ni-Co alloys covering the entire composition range. The curves are of three types corresponding to the γ, the ε, and mixed γ-ε structures. 27 ref. (P16, Ni, Co)

83-P. The Relation Between Energy Levels of the Valence Electrons in Cu and Its Anomalous Temperatures. (In Japanese.) Mituru Sato. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, July 1949, p. 26-28.

Theoretical analysis. (P12, Cu)

84-P. Some Experiments on Fe-Cr-Al Electrical Resistance Wires. (In Japanese.) Kiichiro Shinzi. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, July 1949, p. 47-50.

Effects of Cr, Al, C, Si, and Mn on properties of alloy containing 70-85% Fe. The effects of Al and Si on electrical resistance were most remarkable and oxidation resistance was improved by Cr, Al, and Si. Cold workability was improved by rapid cooling after mild annealing. Ta was most effective in preventing grain growth caused by high-temperature heating, followed by Zr, Ti, and V. (P15, SG-q)

85-P. Crucial Experiment Demonstrating Single Domain Property of Fine Ferromagnetic Powders. C. Kittel, J. K. Galt, and W. E. Campbell. *Physical Review*, ser. 2, v. 77, Mar. 1, 1950, p. 725.

Simple experiment applicable to

Fe and Ni by which single-domain effects were clearly distinguished from the ordinary processes of bulk magnetization. (P16, Fe, Ni)

86-P. Infra-Red Absorption in Silicon. H. B. Briggs. *Physical Review*, ser. 2, v. 77, Mar. 1, 1950, p. 727-728.

Results obtained on unalloyed Si and on six samples prepared by alloying high-purity Si with 0.0005-0.01% B. (P17, Si)

87-P. Thermoelectric Power and Mobility of Carriers in Selenium. Herbert W. Henkels. *Physical Review*, ser. 2, v. 77, Mar. 1, 1950, p. 734-736.

Thermoelectric power of single crystal and microcrystalline Se was investigated as a function of temperature with parameters of crystallization temperature and oxygen content. Simultaneous measurements of resistivity were made in the cases of the microcrystalline samples. (P15, Se)

88-P. A Thermoelectric and Thermodynamic Study of Aluminium-Base Alloys; Effect of Si, Fe, Mg or Ti. C. Crussard and F. Aubertin. *Metal Treatment and Drop Forging*, v. 16, Winter 1949-50, p. 204-208.

Previously abstracted from *Revue de Métallurgie*. See item 16-P, 1950. (P15, P12, Al)

89-P. Magnetic Properties of Palladium-Base Alloys. (In French.) Jules Wucher. *Comptes Rendus* (France), v. 229, Dec. 14, 1949, p. 1309-1310.

Magnetic properties of different alloys of Pd with Cu, Ag, Au, Al, Sn, Pb, and Sb were investigated. Tables and graphs show effects of components in various percentages. (P16, Pd)

90-P. Physical Chemistry of Metallurgical Processes. II. Thermodynamics of Solutions. Application to Liquid Metal Alloys. III. Thermodynamics and Structure of Molten Slags. (In French.) Maurice Rey. *Revue de Métallurgie*, v. 46, Nov. 1949, p. 762-773; Dec. 1949, p. 849-858.

Critical surveys on the basis of the literature. 78 ref. (To be continued.) (P12, B21)

91-P. Research on the Residual Magnetism in Commercial Silicon and Nickel Sheet Iron. (In German.) Hans Wilde. *Frequenz*, v. 3, Nov. 1949, p. 309-319; Dec. 1949, p. 348-353.

Methods of measuring residual magnetism and separating it from hysteresis, effect of eddy currents, and residual losses. Effects of temperature and frequency on permeability, also effects of other factors. 22 ref. (P16, Fe)

92-P. "Thermobimetals". (In German.) J. Bingel. *Archiv für Metallkunde*, v. 3, Dec. 1949, p. 422-427.

Principles of operation of bimetallic thermostats and automatic switches. Thermal coefficients of expansion of various metals and alloys. Design calculations, methods of production, corrosion prevention, and testing of bimetallic assemblies. (P11, SG-a)

93-P. Magnetic Resistance Change and Types of Conductivity. I-II. (In German.) Max Kohler. *Annalen der Physik*, ser. 6, v. 5, nos. 1-2, 1949, p. 89-107.

Part I: On the basis of theoretical considerations, the behavior of bivalent metals in very strong magnetic transverse fields is uniform. Concludes that electrical resistance, in the limiting case of the very strong magnetic field, increases in proportion to the square of the magnetic field. These metals become insulators when their H values are extrapolated to infinity. Part II: A mathematical analysis on the electrical conductivity and Hall coefficient of monovalent metals in a strong magnetic field. 14 ref. (P15, P16)

94-P. Mechanism of "Electrical Erosion" of Metals. (In Russian.) S. L. Mandel'shtam and S. M. Raiskii. *Izvestiya Akademii Nauk SSSR* (Bulletin of the Academy of Sciences of the USSR), Physical Series, v. 13, Sept.-Oct. 1949, p. 549-565.

Experimental investigation confirmed the hypothesis that electrical erosion is a secondary process caused by the disintegrating action of the electric arc on the opposite electrode. Influence of distance between electrodes and of shape and material of electrode on erosion; insulation of electrodes; role of enlargement of electrodes. 12 ref. (P15)

95-P. Use of Measurement of Electric Fluctuations as a Method for Investigating Processes in Metals. (In Russian.) E. Ya. Pumper. *Izvestiya Akademii Nauk SSSR* (Bulletin of the Academy of Sciences of the USSR), Physical Series, v. 13, Sept.-Oct. 1949, p. 596-614.

Studied in connection with electrical resistance of different materials and in connection with fluctuations in electron tubes containing tungsten cathodes. Results confirm validity of the theory of fluctuations proposed. 11 ref. (P15)

96-P. Thermoelectric Emission of Tungsten Coated With Platinum. (In Russian.) M. D. Kruglova and I. L. Sokol'skaya. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, Nov. 1949, p. 1292-1300.

Energy of emission and its dependence on the coating and applied field were established. Curves of evaporation of the Pt layer at different temperatures are plotted and the value of heat of evaporation of Pt from W determined. 10 ref. (P15, W, Pt)

97-P. Kinetics of the Reactions of Columbium and Tantalum With O, N, and H. Earl A. Gulbransen and Kenneth F. Andrew. *Journal of Metals; Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 188, Mar. 1950, p. 586-599.

Reactions were studied in high vacua, using the vacuum microbalance method. Rates of several reactions are compared with other metals. 43 ref. (P12, N15, Cb, Ta)

98-P. The Graphical Representation of Metallurgical Equilibria. C. J. Osborn. *Journal of Metals; Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 188, Mar. 1950, p. 600-607.

Graphs for temperature dependence of free energies of formation of metallurgically important oxides, sulfides, chlorides, carbonates, and sulfates, which simplify derivation of metallurgical information. 70 ref. (P12)

99-P. The Physics of Sheet Steel. (Continued.) G. C. Richer. *Sheet Metal Industries*, v. 27, Feb. 1950, p. 111-115; Mar. 1950, p. 203-206.

Feb. issue: Dynamic vs. static hysteresis and the eddy-current effect. Mar. issue: The eddy-loss problem and single-phase probabilities. (To be continued.) (P16, ST)

100-P. Anomalous Skin Effect in Metals. R. G. Chambers. *Nature*, v. 165, Feb. 11, 1950, p. 239-240.

Study of the above in the range 2-90° K. for Cu, Ag, and Sn. Data are compared with those of Pippard, and of Reuter and Sondheimer. (P15, Cu, Ag, Sn)

101-P. Combustion of Magnesium Powder in Oxygen. (In French.) Hubert Scartazzini. *Comptes Rendus* (France), v. 230, Jan. 2, 1950, p. 97-98.

Spectrographic and pyrometric study of the magnesium-oxygen flame and its temperatures. (P11, Mg)

102-P. The Hall Effect of Rubidium. (In German.) Erich Krautz. *Zeitschrift für Naturforschung*, v. 5a, Jan. 1950, p. 13-15.

Conduction mechanism of Rb in comparison with that of other alkali metals. Apparatus and procedure. (P15, EG-e, Rb)

103-P. The Hall Effect of Iridium. Relationship Between Hall Effect and Arrangement of the Electrons in the Precious Metals. (In German.) P. O. Gehlhoff, E. Justi, and M. Kohler. *Zeitschrift für Naturforschung*, v. 5a, Jan. 1950, p. 16-18.

Determined at room temperature and at 81° K. Hall effects uniformly decrease from Ru to Ag and from Re to Au in the 4th and 5th periodic groups, respectively. This result (which corresponds to the quantum-mechanical explanation of the anomalous Hall effect) is explained in terms of defect electrons. 13 ref. (P15, Ir, EC-c)

104-P. (Book) Symposium on Effects of Low Temperatures on the Properties of Materials. 62 pages. 1946. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Special Technical Publication No. 78.

Considers plastics, elastomers, nonferrous metals, and weldments. Papers concerning metallurgy are abstracted separately. (P general, Q general)

Q

MECHANICAL PROPERTIES AND TEST METHODS; DEFORMATION

140-Q. The Interpretation of Biaxial-Tension Experiments Involving Constant Stress Ratios. S. B. Batdorf. *National Advisory Committee for Aeronautics*, Technical Note 2029, Feb. 1950, 25 pages.

The slip theory of plasticity is applied to the problem of calculating strains associated with the above and is found to be in better agreement with experiment than octahedral-shear and maximum-shear theories usually employed. 15 ref. (Q23)

141-Q. On Elastic Constants of Nickel Crystals. Mikio Yamamoto. *Physical Review*, ser. 2, v. 77, Feb. 15, 1950, p. 566.

Compares data of several Japanese investigators with those of Bozorth and collaborators and other workers. (Q21, Ni)

142-Q. SR-4 Strain Gages Offer Exceptional Possibilities in Tensile Fatigue Tests of Assembled Steel Roller Chain. W. V. Covert. *Testing Topics*, v. 5, Jan.-Mar. 1950, p. 9-10.

Procedures. (Q25, Q7)

143-Q. Effects of Low Temperatures on Electric Strain Gages. E. E. Day. *Trend in Engineering at the University of Washington*, v. 2, Jan. 1950, p. 10-15, 32.

Apparatus and procedure. Studies were made from −300 to 60° F. (Q25)

144-Q. Fatigue Strength of Various Details Used for the Repair of Bridge Members. Wilbur M. Wilson and William H. Munse. *Engineering Experiment Station, University of Illinois.* Bulletin Series No. 382, Dec. 1949, 60 pages. (*Bulletin*, v. 47, no. 30.)

Test methods. Specimens are the product of methods used to shorten eyebars, reinforced bridge members, and splice members in service. Includes tables, graphs, diagrams, and photographs. (Q7, T26, CN)

145-Q. The Properties of Weldments at Low Temperatures. Robert D. Stout. "Symposium on Effects of Low Temperatures on the Properties of Materials", *American Society for Testing Materials*, Special Technical Publication No. 78, 1946, p. 51-59; discussion, p. 60-62.

Notch and bend tests made on carbon-steel specimens. Previous work reviewed. (Q5, CN)

146-Q. Creep and Fatigue Tests on Commercially Extruded Lead and Lead Alloy Pipes. J. McKeown and L. M. T. Hopkin. *Metallurgia*, v. 41, Jan. 1950, p. 135-143.

Reproducibility to be expected from materials produced on commercial presses. It is concluded that the effect of alloying additions cannot be determined on extrusions made on presses where variables are not under sufficient control. (Q3, Q7, Pb)

147-Q. The Effect of Homogenising on the Fatigue Properties of an Extruded Al-Cu-Mg Alloy. H. A. Unckel and H. H. Nyander. *Metallurgia*, v. 41, Jan. 1950, p. 155-156. (Q7, Al)

148-Q. The Application of Electrical Strain Gauges and Brittle Lacquers to Engineering Design. J. S. Caswell. *Metallurgia*, v. 41, Jan. 1950, p. 165-170.

Two methods for determining stresses in engineering structures and components. 13 ref. (Q25)

149-Q. Concerning the Critical Shear Stresses of Binary Alloys. (In Japanese.) S. Takeuchi and H. Suzki. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, May 1949, p. 1-5.

New theory of plasticity based on crystallographic relationship between slip and lattice transformation in supercooled or superheated states. Critical shear stresses of Au-Ag, Cu-Ni, and Cu-Zn alloys are calculated and compared with experimental data. (Q24, Au, Ag, Cu, Ni, Zn)

150-Q. Concerning the Influence of Thickness, Base Metal, and Intermediate Layer on Wear Resistance of Chromium Plating. IV. (In Japanese.) Syuzi Ando. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, May 1949, p. 16-19.

Results of a study of a Cr-plated shuttle body (sewing-machine part). A thickness of 5μ or more was required. Mechanism of wear. (Q9, L17, Cr)

151-Q. The Wear Resistance of Chromium Plating. III. The Relation Between Plating Condition and Wear. (In Japanese.) Matsuhei Kishi. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, May 1949, p. 20-23.

The dry-slip wear test was made for specimens of various types in an Amsler machine. It was found that hard Cr plating and gray Cr plating had high wear resistances. Effects of annealing were determined. (Q9, L17, Cr)

152-Q. Concerning the Difference of Mechanical Properties Between Martempered and Austempered Carbon Steel. I. (In Japanese.) S. Owaku, K. Iijima, and N. Kashiwagi. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, June 1949, p. 29-31.

Experimental results. (Q general, J26, CN)

153-Q. Young's Modulus of Elasticity of Single Crystals of Cobalt. (In Japanese.) Kotaro Honda and Yuki Shirakawa. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, July 1949, p. 23-25.

Young's modulus was measured for three single crystals by a new room-temperature microscopic method. Voigt moduli were calculated. 11 ref. (Q21, Co)

154-Q. Residual Stress in Steels Caused by Various Heat Treatments. (In Japanese.) Tadao Sano. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, July 1949, p. 28-34.

Investigated for 0.6 and 0.9% plain-carbon and 0.3-0.9% C, 3% Ni steels. (Q25, CN, AY)

155-Q. Nitrogen as the Alloying Element in Steel. I. Effect of Nitrogen on Temper-Brittleness in Steels. (In Japanese.) Yunoshin Imai and Tetsuro Ishizaki. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Aug. 1949, p. 11-15.

Investigated by impact and hardness testing of low-Mn steels containing various amounts of N_2. (Q23, AY, N)

156-Q. Comparison of the Properties of Different Heat Resisting Steels. (In Japanese.) Sadao Koshiba and Kosaburo Nobara. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Aug. 1949, p. 25-29.

Thirteen steels were investigated for mechanical properties at room and elevated temperatures, for brittleness caused by heating, and for high-temperature oxidation resistance. Certain recommendations concerning suitable alloys for use in inlet valves of internal-combustion engines are made. (Q general, R2, T7, AY, SG-h)

157-Q. Bearing Properties of Metals and Alloys. III-IV. (In Japanese.) Koichi Mizuno. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Aug. 1949, p. 29-34.

Part I: Results of a study of anodic films on Al alloys. Effects of Mg, Zn, Si, and Cu. Part II: Effects of thin metallic and nonmetallic films on various bearing metals. (Q9, L19, SG-c)

158-Q. Studies on the Changes of Various Properties of Metals and Alloys Due to Twisting. I. (In Japanese.) Nubuo Shiota and Chyoei Onozaki. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Aug. 1949, p. 37-39.

A simple twisting machine. Equipment includes electric furnace for studies at elevated temperatures. Typical results showing transformation curves for various nonferrous alloys. (Q1, Cu, Zn, Al)

159-Q. Universal Instrument for Testing Materials by Means of Natural Bar Frequency. Stephan Thyssen-Bornemisza. *Microtecnic* (English Edition), v. 3, Nov.-Dec. 1949, p. 250-259. Translated from the German.

Commercial apparatus made in Germany. Typical data on modulus of elasticity for various metallic and nonmetallic materials obtained by use of this instrument. (Q21)

160-Q. Structural Foils for Greater Strength. R. E. Higgins and G. G. Havens. *Automotive Industries*, v. 102, Mar. 1, 1950, p. 24-26, 52.

Metallic and nonmetallic sandwich structures in which a core of low-density material is bonded between two thin layers of high-strength material. New type of construction known as "Multiwave" in which the core material is crinkled to form a sine wave which is again crinkled to form a second sine wave having approximately ten times greater amplitude. The wave elements are held together by a crinkled ribbon called a "retainer" or "stabilizer". Mechanical test results for a type having an Al core. (L22, Q general, Al)

161-Q. A Reduction-of-Area Gage for Low-Temperature Application. *Technical News Bulletin* (National Bureau of Standards), v. 34, Feb. 1950, p. 24-26.

Previously abstracted from paper by Glenn W. Geil and Nesbit L. Carwile, *Journal of Research of the National Bureau of Standards*. See item 82-Q, 1950. (Q27)

162-Q. Residual Lattice Strains in Mild Steel. R. I. Garrod. *Nature*, v. 165, Feb. 11, 1950, p. 241-242.

By using different radiations, Greenough has shown, for a number of metals, that residual lattice strains in plastically extended aggregates are present which vary in both magnitude and sign, depending upon grain orientation. He has also proposed a quantitative hypothesis to explain the results. Experiments were made on mild steel to test this hypothesis. Specimens were subjected to a series of homogeneous, uniaxial tensile loads. After each load, they were removed and examined in a precision X-ray back-reflection camera. (Q25, CN)

163-Q. The Behavior of Long Beams Under Impact Loading. *Journal of Applied Mechanics*, v. 17 (*Transactions of the American Society of Mechanical Engineers*, v. 72), Mar. 1950, p. 27-34.

Theoretical and experimental investigation of plastic deformation of long beams. Deflection characteristics of cold rolled steel and annealed copper beams are computed. Essential difference between the two types of materials. (Q6, CN, Cu)

164-Q. Reduction-of-Area Gage Helps Determine Mechanical Properties of Metals at Low Temperatures. *Steel*, v. 126, Mar. 13, 1950, p. 92-93.

See abstract from *Journal of Research of the National Bureau of Standards*, item 82-Q, 1950. (Q27)

165-Q. Resistance of Six Cast High-Temperature Alloys To Cracking Caused by Thermal Shock. M. J. Whitman, R. W. Hall, and C. Yaker. *National Advisory Committee for Aeronautics*, Technical Note 2037, Feb. 1950, 29 pages.

Modified wedge-shaped specimens were uniformly heated to 1750° F. and subjected to a controlled water quench of one edge. This cycle was repeated until a thermal-shock failure occurred. Order of decreasing resistance to cracking was S-816, S-590, Vitallium, 422-19, X-40, and Stellite 6. (Q26, SG-h)

166-Q. Compressive Properties of Titanium Sheet at Elevated Temperatures. Paul F. Barrett. *National Advisory Committee for Aeronautics*, Technical Note 2038, Feb. 1950, 10 pages.

Results of compressive stress-strain tests from room temperature to 800° F. Favorable compressive properties and marked anisotropy in compression were noted. 12 ref. (Q28, Ti)

167-Q. From a Metallurgist's Notebook: Porous Bronze. H. H. Symonds. *Metal Industry*, v. 76, Feb. 10, 1950, p. 109.

Micro-examination of a phosphor bronze sleeve valve which showed radial score marks on the inclined mating face. Conditions of operation had produced excessive wear, particularly on one portion. The large radial fissures are regions where erosion had progressed to a greater extent due to large gas holes present. (Q9, Cu)

168-Q. Factors Affecting the Strength of Metals at High Temperatures. A. G. Metcalfe. *Metal Treatment and Drop Forging*, v. 16, Winter 1949-50, p. 235-246.

A scheme for classification. By adopting a simplified picture of the mechanism, three groups of methods are obtained: first, those which raise the softening temperature; second,

those by which resistance to slip may be raised; third, those which decrease the chance of failure in a grain boundary. Attempts to assess the relative importance of each factor. 48 ref. (Q23, SG-h)

169-Q. Hardness of Cast Iron and Its Relation to Other Mechanical Characteristics. (In French.) Jean Gélain. *Fonderie,* Dec. 1949, p. 1873-1875.

Attempts to correlate hardness with tensile, bending, and impact strengths of cast iron. Dangers of extrapolation which may result in quite large discrepancies between calculated and experimental values. (Q29, CI)

170-Q. Approximate Calculation of the Relationship of the Tensile Strengths of Heat Treated Steels to Their Chemical Composition. (In Italian.) Raffaello Zoja. *Metallurgia Italiana,* v. 41, Sept.-Oct. 1949, p. 229-236.

Two formulas, one approximate and one quite precise. For the latter, some tables have been prepared for convenient interpolation. The formulas were applied to 71 carbon and alloy steels, with good results. (Q23, CN, AY)

171-Q. Calculation of Dimensions of Tensile Test Specimens Cut From Tubes. (In Italian.) F. Bressan. *Alluminio,* v. 18, Nov.-Dec. 1949, p. 609-611.

Proposes an approximate but reliable formula, permitting rapid determination of the necessary size of the test specimen. (Q27)

172-Q. The Problem of Form and Bar-Steel Profiles. (In German.) Bruno Weissenberg. *Stahl und Eisen,* v. 69, Dec. 8, 1949, p. 924-931.

A brief statistical and historical review. Strength and chemical properties of structural steels used in the construction of buildings, ships, bridges, and railroad tracks. Possibilities of improvement; it is proposed that the number of profiles be reduced and more completely standardized on an international scale. (Q23, S22, CN)

173-Q. Present-Day Problems in the Mechanics of Structures. (In German.) Hans Umstätter. *Zeitschrift des Vereines Deutscher Ingenieure,* v. 92, Jan. 21, 1950, p. 57-61.

The effect of flow phenomena on such physical properties of metals as toughness, elasticity, shear strength, etc. Relaxation time as a specific variable; elastic and plastic properties of materials; creep phenomena; stress and strain; tough-elastic hysteresis; and the relaxation spectrum. 16 ref. (Q general)

174-Q. The Expansion Measuring Strip: A New Gage for Static and Dynamic Stresses in Solids. (In German.) Kurt Firk. *Zeitschrift des Vereines Deutscher Ingenieure,* v. 92, Feb. 1, 1950, p. 89-94.

Principles and applications of the electrical-resistance strain gage. 23 ref. (Q25)

175-Q. The Mechanical Properties of Boiler Steels at Elevated Temperatures. (In Swedish.) Gunnar Liljekvist. *Jernkontorets Annaler,* v. 133, no. 11, 1949, p. 519-540.

Mechanical properties, especially yield points, of 14 Swedish boiler steels were investigated at elevated temperatures. Average yield points at temperatures between −40 and 400° C. are charted. Tensile strength, elongation, and reduction in area are also shown graphically. (Q23, CN)

176-Q. Concerning Indirect Methods of Calculation of True Resistance to Fracture. (In Russian.) A. I. Chilizhenko. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Dec. 1949, p. 1452-1457.

Critically analyzes formulas proposed by several Russian authors. Shows that they are not applicable to previously deformed specimens. Proposes two new formulas, one for annealed metal, the other for cold or hot rolled metal. Data for ferrous and nonferrous metals and alloys are tabulated and charted. 14 ref. (Q26)

177-Q. Concerning Plastic Bending. (In Russian.) V. P. Romanovskii. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Dec. 1949, p. 1459-1467.

Critically analyzes the hypothesis and formula of M. P. Markovets relating to degree of deformation. Ratio between the radius of the mandrel (in the bending test) and thickness of the test specimen are of primary importance. In calculation of the degree of deformation, two different formulas must be used. Both are given and interpreted for different values of the variables. (Q5)

178-Q. Determination of Conditional Limit of Elasticity of Flat Springs Under Pure Bending Stress. (In Russian.) V. Ya. Zubov. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Dec. 1949, p. 1486-1487.

Theoretical analysis. Influence of temperature of annealing on steel springs. (Q21, Q5, T7, ST)

179-Q. Two-Prong Indicator for Photographic Recording of Dynamic Stresses. (In Russian.) L. A. Goncharskii. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Dec. 1949, p. 1488-1490.

Sensitive device. (Q25)

180-Q. Method of Experimental Investigation of Shear Deformation. (In Russian.) S. E. Khanin. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Dec. 1949, p. 1492-1494.

Method for experimental determination of tangential stresses during shear resulting in deformations which are determined by a system of mirrors. (Q2)

181-Q. Fatigue Testing of Valve Springs With Surface Defects. (In Russian.) V. B. Raitses. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Dec. 1949, p. 1494-1496.

Types of surface defects and their influence on fatigue strength of valve springs. Test data indicate that the most reliable method for their evaluation is a fatigue test under operating stress for at least 15-17 million cycles. (Q7, T7, AY)

182-Q. Wear Tests on Grinding Balls. T. E. Norman and C. M. Loeb, Jr. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 330-360.

Previously abstracted from *Mining Technology.* See item 3b-58, 1948. (Q9, B13)

183-Q. Discussions of a Century Ago Concerning the Nature of Fatigue, and Review of Some of the Subsequent Researches Concerning the Mechanism of Fatigue. R. E. Peterson. *ASTM Bulletin,* Feb. 1950, p. 50-54; discussion, p. 54-56.

The general state of knowledge of mechanics of materials at the time of a meeting of the Institution of Mechanical Engineers at Birmingham, England, in 1849, and the nature of fatigue of metals. Some subsequent researches concerning the mechanism of fatigue. 44 ref. (Q7)

184-Q. Large-Scale Torsional Fatigue Testing of Marine Shafting. *Journal of the American Society of Naval Engineers,* v. 62, Feb. 1950, p. 185-201.

Previously abstracted from *Institution of Mechanical Engineers, Proceedings,* 1948. See item 9b-21, 1948. (Q7, T22, ST)

185-Q. Studies on Fly-Ash Erosion. M. A. Fisher and E. F. Davis. *Journal of the American Society of Naval Engineers,* v. 62, Feb. 1950, p. 211-223.

Erosion of turbine blades and other metal parts by fly ash suspended in hot combustion gases, as would occur in pulverized-coal-fired turbines. Special test apparatus designed to simulate operating conditions. Metals used included a carbon steel, cast Vitallium, and several special alloy steels. (Reprinted from *Mechanical Engineering;* see item 3A-31 and 3A-119, 1949.) (Q9, T25, CN, AY, Co)

186-Q. Internal Friction of Cold-Worked Metals at Various Temperatures. T'ing-Sui Ke. *Transactions of the American Institute of Mining and Metallurgical Engineers,* v. 188, Mar. 1950, p. 575-580.

Change of internal friction when severely cold worked Al was annealed at successively higher temperatures until it was completely recrystallized. Relationship to temperature of annealing, aging time, and amount of cold work. Effect of impurities. 19 ref. (Q22, N5, Al)

187-Q. Inductance Unit Regulates Fatigue Loads. *Product Engineering,* v. 21, Mar. 1950, p. 100-101.

Vibrating loads as high as 10,000 lb. can be obtained on the Sonntag Model SF-10-U machine. Fatigue tests can be performed on large machine parts and assemblies. Includes means for compensating for load variations caused by permanent deformation of the specimen during test. (Q7)

188-Q. Portable Hardness Testing Device. *Product Engineering,* v. 21, Mar. 1950, p. 103.

Dial-gage device permits rapid, on-the-spot hardness tests on finished assemblies or raw stock. (Q29)

189-Q. Free Machining Steels. *Product Engineering,* v. 21, Mar. 1950, p. 150-151. Condensed from paper by W. Lee Williams.

Previously abstracted from *Journal of the American Society of Naval Engineers.* See item 3B-208, 1949. (Q23, Q6, CN, AY, SG-k)

190-Q. Induflux: New Method for Testing Fatigue in Sucker Rods. D. H. Stormont. *Oil and Gas Journal,* v. 48, Mar. 16, 1950, p. 84, 86.

Apparatus and method indicating relative amount of fatigue and variations in grain structure resulting from heat treating. These conditions and their degree are determined by measurements of differences in magnetic properties. (Q7, ST)

191-Q. Direct Explosion of Welded Joints. G. S. Mikhalapov. *Welding Journal,* v. 29, Mar. 1950, p. 109s-122s.

New technique for determining triaxial sensitivity of steel plates and weldments. Results obtained with numerous combinations of electrodes and low-alloy steels. Typical fractures. (Q26, Q25, K9, CN)

192-Q. Weld Embrittlement in Chromium Stainless Steels. Helmut Thielsch. *Welding Journal,* v. 29, Mar. 1950, p. 126s-132s.

A new type of embrittlement occurring in low-carbon high-chromium irons was investigated using high-temperature furnace quench tests, induction heating techniques, and weld tests. Water quenching or air cooling of Types 405, modified 410 (less than 0.08% C), and 430 stainless irons from temperatures above 2200-2300° F. produces rather abrupt embrittlement and increased hardness. Embrittlement seems to accompany severe grain growth. Hardness values alone do not give a true (relative) indication of other mechanical properties of these irons. With the exception of excessive grain growth, the detrimental effects of overheating may be

removed by annealing between 1350 and 1450° F.
(Q23, K general, J general, SS)

193-Q. Properties of a Boron Carbide-Iron Ceramal. W. G. Lidman and H. J. Hamjian. *National Advisory Committee for Aeronautics,* Technical Note 2050, Mar. 1950, 23 pages.

Materials containing approximately 13% Fe by volume from 1600-2600° F. were investigated to obtain information on ceramals that form a bonding phase. Room and elevated-temperature modulus of rupture, resistance to fracture by thermal shock, density, and oxidation characteristics were evaluated and compared with those of hot-pressed B_4C.
(Q23, H11, B, SG-h)

194-Q. Steel Castings. Test Blocks: A Review of Available Data. H. T. Protheroe. *Iron and Steel,* v. 23, Mar. 1950, p. 79-84.

Critical analysis of the results of tensile tests from differently designed test blocks. Results indicate that separately cast test pieces are better than those cut from castings. 14 ref. (Q27, CI)

195-Q. Buckling of Compressed Steel Members. Georg Wastlund and Sven G. Bergstrom. *Transactions of the Royal Institute of Technology,* No. 30, 1949, 172 pages.

Reviews fundamental problems met in design. Buckling of centrally compressed bars; combined tension and bending; tests of bars of frames of ST52 steel; proposed Swedish specifications; and built-up compressed chambers. 59 ref. (Q28, ST)

196-Q. Anistropy, Mechanical Properties, and Normalization of Gray Cast Iron. (In French.) Albert Collaud. *Von Roll Mitteilungen,* v. 8, Jan.-Dec. 1949, p. 3-164.
(Q general, J24, CI)

197-Q. Problems of Wear Resistance in Machine Construction. (In Russian.) I. A. Oding. *Izvestiya Akademii Nauk SSSR* (Bulletin of the Academy of Sciences of the USSR), Section of Technical Sciences, Dec. 1949, p. 1774-1782.

Trends in machine design requiring higher wear resistance and more accurate determination of operating stresses; also resulting problems of static and dynamic strength, especially at high temperatures, from experimental and theoretical viewpoints. (Q9, Q23, SG-h)

198-Q. (Book) **Manual on Fatigue Testing.** American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Special Technical Publication No. 91, 1949, 82 pages. Cloth cover, $3.15; paper cover, $2.50.

Symbols, nomenclature, testing machines, specimens and their preparation, test procedure, and presentation and interpretation of data. 222 ref.
(Q)

199-Q. (Book) **Steels for Elevated Temperature Service.** 87 pages. 1949. U. S. Steel Corp., Pittsburgh.

General principles of behavior. Test methods and laboratory techniques. Tabular and graphical data on mechanical properties of 21 steels covering a wide variety of chemical compositions. Testing facilities of U. S. Steel Co. p. 37 ref.
(Q general, ST, SG-h)

200-Q. (Book) **Photo-Elasticity: Principles and Methods.** H. T. Jessop and F. C. Harris. Cleaver-Hume Press, Ltd., 42a, South Audleystreet, London, W.1, England. 28s. net.

Explanation of mathematical ideas and methods involved in the analysis of stress distribution in one plane; optical aspects. Polarization and double refraction; the theory of photoelasticity; the problem of stresses in three dimensions. Various methods of interpetation and reduction of observations which may be used in typical cases. (Q25)

R

CORROSION

69-R. Chipboard Eliminates Corrosive Etching on Steel Sheets. *Iron Age,* v. 165, Feb. 23, 1950, p. 85.

How etching normally occurring on the bottom sheet of stacks resting on wooden skids and pallets can be eliminated by use of a specially coated chipboard made from pulpboard used in making paper boxes.
(R2, A5, ST)

70-R. Formation of Hair Line Cracks by Hydrogen Introduced Into Steel by Electrolysis. G. A. Geach. *Research,* v. 3, Feb. 1950, p. 98.

Experimental results. (R2, ST)

71-R. A Brief Survey of Stress and Corrosion Cracking in Brass. R. Stettler. *Sheet Metal Industries,* v. 27, Feb. 1950, p. 119-122.

Previously abstracted from original in *Pro-Metal.* See item 6C-60, 1949.
(R1, Cu)

72-R. Corrosion Resistance of Analytical Weights. P. H. Bigg and F. H. Burch. *Nature,* v. 165, Feb. 4, 1950, p. 201.

Resistance of various types to laboratory atmosphere corrosion. Results show superiority of polished 25-20 Cr-Ni stainless steel. Plated weights were subject to considerable weight change. (R3, T8, SS)

73-R. The Corrosion of the Austenitic Stainless Steels. Part I. Types of Stainless Steel and Forms of Attack. G. T. Colegate. *Metallurgia,* v. 41, Jan. 1950, p. 147-150.

Effect of alloying elements in addition to Cr and Ni and of corrosive media with which the material may come into contact in service.
(R general, SS)

74-R. The Corrosion of Metals. W. H. J. Vernon. *Journal of the Birmingham Metallurgical Society,* v. 29, Dec. 1949, p. 198-221.

Second of two lectures deals with preventive measures. Main classes are: Methods based on modification of design or procedure; methods based on modification of environment; methods based on modifications of metal; and methods based on protective coatings. 41 ref.
(R10, L general)

75-R. The Tarnish-Resisting Silver Alloys. I. (In Japanese.) Keizaburo Miyata, Tomojiro Tottori, and Masazo Okamoto. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, May 1949, p. 40-42.

Effects of small quantities of various added elements on the tarnish resisting properties of Ag-base alloys were investigated by examining the degree of tarnishing produced when immersed in 0.1N Na_2S solution. The invisible films formed by heating these alloys in air or in controlled atmospheres of low pressure were found to be highly protective against tarnishing. Good results were obtained from binary Ag alloys containing Zn. (R2, Ag)

76-R. Intergranular Attack on Steel by Penetration of Molten Salt. (In Japanese.) M. Kawakami and K. Ogawa. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, June 1949, p. 36-39.

It was found that part of the molten salt diffuses into the steel, mainly at grain boundaries. Diffusion constants and their variations with temperature were determined. If the steel pieces are made cathodes and d.c. applied, the diffusion is prevented. (R2, R6, ST)

77-R. The Corrosion Mechanism of Cu and Its Alloys in Methanol. (In Japanese.) Tadayoshi Inui, Shiro Ogawa, and Toshizi Shirai. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, July 1949, p. 39-43.

Results of experimental investigation of the above. Pure methanol does not react, but after aging, a brownish black corrosion product is formed, identified by electron diffraction to be Cu_2O. A possible mechanism involving air oxidation of CH_3OH to CH_2O and HCOOH is outlined. (R7, Cu)

78-R. Studies on the Corrosion of Tin. IV. (In Japanese.) H. Endo and G. Yokoyama. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, July 1949, p. 43-47.

Results obtained with HCl, H_2SO_4, and HNO_3 vs. pure Sn and full ranges of its binary alloys with Al, Bi, Cd, Cu, Pb, Sb, and Zn. (R5, Sn)

79-R. The Corrosion of Impure Aluminum. I. Effect of Fe, Si and Cu. II. Effect of Mg, Mn, Sb, and Si. (In Japanese.) Ichiji Obinata and Seiichi Nishikawa. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, Aug. 1949, p. 7-11.

Part I: Weight decreases and decreases in tensile strength and elongation of Al containing varying amounts of Fe, Si, and Cu, upon immersion in 3% NaCl and 0.5 *N* HCl. In general, the effect of Cu is most harmful, followed by Fe and Si. Part II: Varying amounts of Mg, Mn, Sb, and Si were added to 98% Al containing 1.2% Fe and 0.8% Si to improve corrosion resistance in the same media, and also in 0.5 *N* NaOH. (R5, Al)

80-R. Porosity of Electrodeposited Metals. VI. Effect of Surface Structure of the Base Metal on the Permeability and Corrodibility of Deposits. N. Thon, Ling Yang, and Denis Kelemen. *Plating,* v. 37, Mar. 1950, p. 280-281, 284.

Deposits of the same metal, produced under otherwise identical conditions with unequal gas permeabilities of thin foils, generally corrode at unequal rates. Experimental data cover Ni and Fe deposits on stainless steel and Cu. (R2, Cu, Ni, Fe, SS)

81-R. Reaction of Iron With Organic Sulfur Compounds. Lyle A. Hamilton and W. W. Woods. *Industrial and Engineering Chemistry,* v. 42, Mar. 1950, p. 513-519.

Between 125 and 275° C., many organic compounds containing bivalent sulfur react with iron forming principally FeS. This reaction is common both to corrosion problems and to the action of sulfur compounds as extreme-pressure lubricant additives. Experiments on the reaction of iron and copper with several sulfur compounds. Two different corrosion processes appear to be involved; both of which terminate in the formation of the same FeS on the iron surface.
(R7, Fe, Cu)

82-R. Corrosion. Mars G. Fontana. *Industrial and Engineering Chemistry,* v. 42, Mar. 1950, p. 83A-84A.

Use of Al, Cu, and their alloys for purposes requiring corrosion resistance. (R general, Al, Cu)

83-R. A Unified Mechanism of Passivity and Inhibition. Part II. R. B. Mears and R. H. Brown. *Journal of the Electrochemical Society,* v. 97, Mar. 1950, p. 75-82.

The inhibiting action of sodium chromate on localized corrosion of Al exposed to a NaCl solution is mainly the result of polarization of the local

anodes. Polarization curves are of value in studying the mechanism of inhibitor action only if information on local cell behavior can be derived from them. Two indirect methods of estimating anodic and cathodic polarization curves of the local cells. The relationship of "reversible" potentials of metals as calculated from free-energy data and as measured in aqueous solutions. (R10, Al)

84-R. Corrosion and Its Causes. N. P. Peifer. *American Gas Association Monthly*, v. 32, Feb. 1950, p. 48-50, 58.

An elementary explanation of the various types. (R general)

85-R. What You Should Know About Corrosion of Ferrous Metals. George D. Lain. *Steel*, v. 126, Mar. 13, 1950, p. 101-102, 104.

See abstract from *American Iron and Steel Institute*, "Technical Committee Activities", 1949, item 41-R, 1950. (R general, Fe)

86-R. Investigation of Fretting Corrosion by Microscopic Observation. Douglas Godfrey. *National Advisory Committee for Aeronautics*, Technical Note 2039, Feb. 1950, 31 pages.

Glass, other noncorrosive materials, and metals were used. Convex surfaces were vibrated in contact with stationary flat surfaces. Fretting corrosion was caused by removal of finely divided and apparently virgin material due to inherent forces; its primary reaction is independent of vibratory motion or high sliding speeds. (R1)

87-R. Rapid Oxidation of Metals and Alloys in the Presence of Molybdenum Trioxide. J. L. Meijering and G. W. Rathenau. *Nature*, v. 165, Feb. 11, 1950, p. 240-241

Temperature dependence of the influence of molybdenum trioxide on the oxidation of Al-Cu, Cu, Ag, and Al-Ag was studied. Rate of oxidation is markedly increased at such low temperatures (below 500° C.) that thermal decomposition can be disregarded. Surface conditions of the specimens were examined. (R2, R6, Al, Cu, Ag)

88-R. The Passivity of Metals. Part X. The Mechanism of Direct Dissolution of Ferric Oxide. M. J. Pryor and U. R. Evans. *Journal of the Chemical Society*, Dec. 1949, p. 3330-3336.

α-Ferric oxide was found to dissolve comparatively rapidly in HF or concentrated HCl, which readily form soluble complexes with ferric ions. In dilute solutions of HCl, H_2SO_4, or $HClO_4$, rate of dissolution falls off with time, and the resulting solutions contain ferrous iron. Mechanisms are suggested. (R10, Fe)

89-R. From a Metallurgist's Notebook: Intergranular Embrittlement. H. H. Symonds. *Metal Industry*, v. 76, Feb. 17, 1950, p. 127-128.

Investigation revealed that failure of small pieces of extruded copper on bending was due to intergranular embrittlement resulting from treatment in a partially reducing atmosphere. (R2, Cu)

90-R. Copper Water Pipes; Result of B.N.F.M.R.A. Investigation on Corrosion. *Metal Industry*, v. 76, Feb. 17, 1950, p. 129-130.

Cause of occasional pitting was traced to carbonaceous films produced on the pipes during the manufacturing operation. Occurrence of these films can easily be prevented and the pitting thus avoided. (R2, Cu)

91-R. Electrochemical Studies of Protective Coatings on Metals. Part II. Resistance and Capacitance Measurements on Painted Steel Immersed in Sea Water. F. Wormwell and D. M. Brasher. *Journal of the Iron and Steel Institute*, v. 164, Feb. 1950, p. 141-148.

Changes in electrical properties showed good correlation with incidence and progress of corrosion of the underlying metal. The technique was used to investigate the influence of type of paint, of adverse conditions during painting, and of aeration and stirring. 17 ref. (R11, L26, ST)

92-R. The Costs of Corrosion and of Its Control. W. H. J. Vernon. *Engineering*, v. 169, Feb. 10, 1950, p. 160-161. A condensation.

A survey. (R general)

93-R. The Corrosion of Ferrous Metals. W. Westwood and R. I. Higgins. *Proceedings of the Technical Section, Paper Makers' Association of Great Britain & Ireland*, v. 29, Dec. 1948, p. 267-283; discussion, p. 283-301.

As encountered in the papermaking industry. Various types of corrosion and methods of protection. (R general, T29, Fe)

94-R. Mechanism of Action of Chromates During Corrosion of Plain and Stainless Steels in a Liquid Medium. (In French.) L. Cavallaro, A. Indelli, and A. Tani. *Revue de Métallurgie*, v. 46, Dec. 1949, p. 818-820; discussion, p. 820.

Mechanism of chromate inhibition. Results indicate that it is caused by intensification of the "barrier" effect due to "electrochemical inertia" of the transition metals. (R10, CN, SS)

95-R. Testing of Heat Resistant Alloys for Resistance to Corrosion by Combustion Gases. (In French.) P. Galmiche. *Revue de Métallurgie*, v. 46, Dec. 1949, p. 843-848.

Eight different alloy steels were tested; apparatus and procedure. Surface microstructures. Includes evaluation of effects of combustion-gas composition. (R9, AY, SG-gh)

96-R. Evaluation of the Effects of Rust on Sheet Steel. (In Italian.) V. Montoro and G. Canesi. *Metallurgia Italiana*, v. 41, Sept.-Oct. 1949, p. 225-228.

Method devised for determination of effects of rust on mechanical properties. Correlates decrease in the latter with decrease in thickness of unoxidized steel. (R2, ST)

97-R. The Application of Wagner's Scaling Theory of the Development of Scale-Resistant Alloys. (In German.) Karl Hauffe. *Metalloberfläche*, sec. A, v. 3, Dec. 1949, p. 213-214.

Wagner-Schottky's disorientation theory and how it can be used. 12 ref. (R2)

98-R. Forms of Corrosion on Light Metal Alloys. (In German.) P. Brenner. *Metalloberfläche*, sec. A, v. 4, Jan. 1950, p. 1-9.

Summary of different types of corrosion. 18 ref. (R1, R2, Al)

99-R. The Effect of Hydrogen on Corrosion Resistance, Anodic-Film Formation, and Workability of Aluminum-Magnesium Alloys. (In German.) H. Vosskühler. *Metall*, v. 4, Jan. 1950, p. 6-9.

Hydrogen in Al-rich alloys reduces their resistance to ordinary and stress-corrosion and results in decreased workability as indicated by hole-drilling tests. Includes photographs, tables, and graphs. (R1, Q23, Al)

100-R. Soil-Corrosion Studies, 1946: Ferrous Metals and Alloys. Irving A. Denison and Melvin Romanoff. *Journal of Research of the National Bureau of Standards*, v. 44, Jan. 1950, p. 47-76.

Measurements on a variety of wrought and cast ferrous materials after exposure to different soil conditions for periods up to 14 years. The steels ranged in composition from fractional percentages of Ni and Cr to the high concentrations typical of wholly austenitic steels. Magnitude and progress of corrosion with respect to weight loss and pitting are interpreted in relation to properties of the soils. Compares corrosion of plain wrought materials and cast iron. (R8, Fe, ST)

101-R. Durability Tests of Metalite Sandwich Construction. David G. Reid. *ASTM Bulletin*, Feb. 1950, p. 28-31.

Material consists basically of a relatively thick end-grain balsa core to which are bonded thin facings of high-strength aluminum alloy. Effects of accelerated exposure of edge-protected and unprotected specimens to atmospheric and salt-spray on weight change, tensile strength, and fatigue strength. (R11, Al)

102-R. Correlation of Accelerated Weathering Machines. Roy W. Hill, George S. Cook, and William E. Moyer. *ASTM Bulletin*, Feb. 1950, p. 32-43.

Investigation made to correlate exposure results obtained from the Atlas Twin Arc Weatherometer with those obtained from the National Carbon X1A Accelerated Weathering Machine. Results agreed satisfactorily if the paint is dip-applied on primed metal panels and if certain other requirements are complied with. (R11, L26)

103-R. Kinetics of the Oxidation of Titanium. W. A. Alexander and L. M. Pidgeon. *Canadian Journal of Research*, v. 28, sec. B, Feb. 1950, p. 60-82.

Rates of oxidation of Ti powder and sintered bars were investigated from 25 to 550° C. at pressures of 2 and 20 cm. O_2. Shows that the oxidation process can be divided into two mechanisms; equations representing each. 43 ref. (R2, Ti)

104-R. Experience With Two Graphite Ground Beds in Dry Lakes. R. J. Emerson. *Corrosion*, v. 6, Mar. 1950, p. 79-81.

Cathodic corrosion prevention setups for pipe lines laid in dry lakes (salt beds) of highly corrosive character. (R10, ST)

105-R. Field and Laboratory Evaluation of Petroleum-Base Rust Preventives. E. L. Walters and R. G. Larsen. *Corrosion*, v. 6, Mar. 1950, p. 92-103; discussion, p. 103-104.

Evaluation in the light of field performance under conventional conditions of exposure. A statistical analysis of the influence of atmospheric environment, composition, and application variables upon the performance characteristics of both rust-preventive coatings and films. Field and laboratory behavior are correlated. (R11, Fe)

106-R. The National Association of Corrosion Engineers: Its Aims and Role in the Development of Experience in Combating Corrosion Problems. F. L. LaQue. *Corrosion*, v. 6, Mar. 1950, p. 88-91.

(R general)

107-R. Polarographic Study of Corrosion Phenomena. I. Introduction—Experimental Technique—Analysis and Interpretation of Polarograms. Pierre Van Rysselberghe, John M. McGee, Armin H. Gropp, Robert D. Williams, and Paul Delahay. *Corrosion*, v. 6, Mar. 1950, p. 105-113.

Previously abstracted from *Corrosion and Material Protection*. See item 11-95, 1948. (R11)

108-R. Condensation of First Interim Report on Ground Anode Test of Sub Committee TP-3—Anodes for Impressed Currents. *Corrosion*, v. 6, Mar. 1950, p. 114.

Installation procedure, operating data, and preliminary conclusions obtained from the first year of 4-yr. test. (R10)

109-R. Factors To Be Considered in Using Salt Spray Testing. Allen G. Gray. *Products Finishing*, v. 14, Mar. 1950, p. 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80.
(R11)

110-R. The Choice and Interpretation of Corrosion Tests. G. T. Colegate. *Sheet Metal Industries*, v. 27, Mar. 1950, p. 259-266.
(R11)

111-R. Corrosion Damage to Interior of Vessel Walls From Hydrogen Blistering Studied. *Petroleum Processing*, v. 5, Mar. 1950, p. 253-255.
Results of recent work on steel vessels by Standard Oil of Ohio, General Petroleum Corp. of Calif., Shell Development Co., and Continental Oil Co. (R2, T29, ST)

112-R. Stress-Corrosion Cr[illegible] of Mild Steel. Daniel Cubicciotti[illegible] William Boyer. *Welding Journ[illegible]* 29, Mar. 1950, p. 140s-145s.
Progress report on investigations of mild steel wires, covering effects of heat treatments and concentration, and composition of corroding liquid. Various nitrate-salt solutions were used. 10 ref. (R1, CN)

113-R. Stress-Corrosion in Radial-Flow Steam Turbines. G. H. Wray. *Engineering*, v. 169, Feb. 10, 1950, p. 141-143; Feb. 17, 1950, p. 169-171; Feb. 24, 1950, p. 217-218.
Investigation and research on cold work effects of rolling Cr-Ni-Mo steel dovetail blade fixtures during manufacture of blade rings for the Brush Ljungstrom double-rotation turbine. Laboratory-test and service failures. Effects of various heat treatments on structure. (R1, F23, N8, T25, AY)

114-R. From a Metallurgist's Notebook: Corrosion of Aluminium. H. H. Symonds. *Metal Industry*, v. 76, Feb. 24, 1950, p. 150, 152.
Results of examination of cast Al kettle spouts which showed corrosion on the polished surfaces. The remedy is stated to be the production of sounder castings. (R general, Al)

115-R. Corrosion and Chemical Testing of Waters for Subsurface Injection. Part I. J. Wade Watkins. *Producers Monthly*, v. 14, Feb. 1950, p. 15-19.
Corrosion test methods and chemical analyses used in a study of plants that condition various surface waters and brines used for water flooding, brine disposal, and reservoir pressure maintenance. (To be continued.) (R4)

116-R. Concerning the Brittleness Caused by Alkalis. (In French and German.) Keel. *Zeitschrift für Schweisstechnik; Journal de la Soudure*, v. 40, Feb. 1950, p. 35-36.
Cracking of weld beads in steel caused by alkalis. (R5, K9, ST)

S

INSPECTION AND CONTROL

86-S. Ferrous Metallurgy. H. F. Beeghly. *Analytical Chemistry*, v. 22, Feb. 1950, p. 235-238.
Reviews recent literature on analysis of ferrous metals. 95 ref.
(S11, Fe)

87-S. Nonferrous Metallurgy. H. V. Churchill. *Analytical Chemistry*, v. 22, Feb. 1950, p. 238-240.
Reviews recent literature on analysis of nonferrous metals. 111 ref.
(S11, SG-a)

88-S. Determination of Oxygen in Titanium. Dean I. Walter. *Analytical Chemistry*, v. 22, Feb. 1950, p. 297-303.
Modified vacuum-fusion techniques. The sample to be analyzed reacts with powdered graphite, in the presence of tin, to form the stable carbide of titanium and reduce the oxides. The evolved gases are extracted and analyzed. (S11, Ti)

89-S. Radiometric Determination of Gold and Rhenium. Edward D. Goldberg and Harrison Brown. *Analytical Chemistry*, v. 22, Feb. 1950, p. 308-311.
Methods developed for determination of Au and Re using slow-neutron activation analysis. 12 ref. (S11, Au, Re)

90-S. Vacuum Fusion Furnace for Analysis of Gases in Metals. W. G. Guldner and A. L. Beach. *Analytical Chemistry*, v. 22, Feb. 1950, p. 366-367.
Furnace of radically modified design which has been used on a variety of metals and alloys for the past two years. (S11, EG-m)

91-S. The Radiographic Inspection of Welds as Applied in the Shipbuilding Industry. L. Mullins. *Sheet Metal Industries*, v. 27, Feb. 1950, p. 151-158, 162.
Scope, costs, training, equipment, safety precautions, technique, interpretation, and reporting procedures. (S13, T22, ST)

92-S. Radium, Tantalum^{182}, and Cobalt^{60} in Industrial Radiography. James W. Dutli, Gerold H. Tenney, and John E. Withrow. *U. S. Atomic Energy Commission*, AECD-2719 (LADC-712), Sept. 23, 1949, 10 pages.
Use of Ta^{182} and Co^{60} as sources of radiation was investigated and compared with Ra. Technique charts were developed for thicknesses up to 3 in. for Al, Zn, Fe, Sn, Cu, and Pb. Resolution, sensitivity, and half-life values were compared.
(S13, Al, Zn, Fe, Sn, Cu, Pb)

93-S. Automatic Control of Electrodes in Arc Furnaces. G. Reginald Bashforth. *Metallurgia*, v. 41, Jan. 1950, p. 153-154.
Two types of regulators and their applications. (S18)

94-S. Sound Testing Searches Out Rail Defects Within Limits of Joint Bars. H. C. Drake. *Railway Age*, v. 128, Mar. 4, 1950, p. 55-58.
Car-mounted ultrasonic reflectoscope which discloses bolt-hole breaks, head-and-web separations, and other failures rapidly without necessity of dismantling rail-end assemblies.
(S13, T23)

95-S. On the Determination of the Roughness of Metallic Surfaces. Carl Wagner. *Journal of the Electrochemical Society*, v. 97, Mar. 1950, p. 71-74.
Polarization capacity of an electrode can be measured readily with the aid of a ballistic galvanometer. The polarization capacity per unit apparent area is approximately proportional to the roughness of the electrode surface. Results obtained for silver electrodes illustrate the influence of pretreatment and aging. 38 ref. (S15)

96-S. How To Determine Oxygen in Metals by Fast Vacuum Fusion Method. R. K. McGeary, J. K. Stanley, and T. D. Yensen. *Steel*, v. 126, Mar. 6, 1950, p. 80-82, 118.
See abstract of *American Society for Metals*, Preprint 10, item 10A-130, 1949. (S11, O)

97-S. Light Rays Can Be Tools. (Concluded.) A. R. Fultz. *Tool & Die Journal*, v. 15, Mar. 1950, p. 47-51, 100.
Optical gaging devices. (S14)

98-S. How Ford Applies Statistical Quality Control. *Production Engineering & Management*, v. 25, Mar. 1950, p. 51-54.
(S12)

99-S. Instantaneous Quality Control: New Method of Reducing Manufacturing Costs. *Steel*, v. 126, Mar. 13, 1950, p. 99-100.
Electric computor called a "quality-control indicator", which keeps an automatic, continuous check on reject rates in manufacturing operations. (S12)

100-S. Red Means Danger. Rebecca H. Smith. *Western Machinery and Steel World*, v. 41, Feb. 1950, p. 70-72.
"DPM" (dye penetrant method) for surface-defect detection, developed and used on gas-turbine parts. (S13)

101-S. Versatile X-Ray Intensity Meter. William B. Lurie. *Electronics*, v. 23, Mar. 1950, p. 74-77.
Device permits rapid exploratory measurements, continuous monitoring, or work involving a large number of readings within a short time. Detector probe may be carried by hand for portable applications or permanently mounted for gaging thin materials during production. Typical applications. (S14)

102-S. Spectrometric Analysis of Bronze. Peter J. Gruszecki. *Foundry*, v. 78, Mar. 1950, p. 92-93, 146.
Developed to extend the range to very high percentages. Technique for determination of Pb, Sn, Zn and Ni in bronze alloys. (S10, Cu)

103-S. Life Tests of Tungsten and Tantalum Filaments in Ion Gauges. W. E. Bush. *U. S. Atomic Energy Commission*, AECD-2682, Jan. 8, 1944, 15 pages.
Relative life of filaments operated at low emission (low temperatures) compared to those operated at high emission; dependence of life upon the initial diameter; effect of varying concentrations of water vapor and air upon life; and life characteristics of Ta as compared to W.
(S21, T1, W, Ta)

104-S. Analytical Chemistry. 1. Introduction. H. Irving. **2. Analytical Emission Spectrography.** H. R. Clayton. **3. Flame Photometry.** L. Leyton. **4. Volumetric Analysis.** H. Irving. *Annual Reports on the Progress of Chemistry*, v. 45, 1948, p. 316-330.
Reviews recent progress in the above fields. 199 ref. (S11)

105-S. Repeatability of Test Results. E. D. van Rest. *Nature*, v. 165, Feb. 11, 1950, p. 230-231.
Discussion at a recent meeting of the London Group of the Royal Statistical Society's Industrial Applications Section. (S12)

106-S. Interferometric Study of Metal Surfaces; Application of the Multiple-Beam Technique. S. Tolansky. *Metal Treatment and Drop Forging*, v. 16. Winter 1949-50, p. 195-203.
Technique and typical results.
(S15)

107-S. Cast Iron From the Point of View of the Purchaser. W. P. Smith. *Foundry Trade Journal*, v. 88, Feb. 9, 1950, p. 139-144; discussion, p. 144-146.
Procedures for testing purchased castings, both by nondestructive and destructive methods. Examples are quoted and related to foundry processes. (S general, CI)

108-S. The Use of Multi-Jet Electrodes in Polarographic Analysis. (In English.) S. T. Payne. *Analytica Chimica Acta*, v. 3, Dec. 1949, p. 686-692.
Principles of polarography. Simultaneous use of a number of dropping electrodes immersed in the same solution increases the sensitivity of the normal methods and minimizes oscillations in current value caused by formation and release of the mercury drops. (S11)

109-S. Radioactive Indicators in Metallurgy. (In French.) M. Haissinsky. *Métaux & Corrosion*, v. 24, Dec. 1949, p. 275-279.

Applications to solid-state reactions, i.e., diffusion in metals. 45 ref. (S19, N1)

110-S. Detection of Cracks by "Sweating". (In French.) H. de Leiris. *Revue de Métallurgie,* v. 46, Dec. 1949, p. 797-802.

Several methods, including the "Zyglo" fluorescent-liquid method and one using a highly colored liquid. The latter is recommended. (S13)

111-S. Instantaneous Spectrography. (In French.) J. Orsag. *Revue de Métallurgie,* v. 46, Dec. 1949, p. 803-805; discussion, p. 805-806.

A newly developed spectrograph directly connected with a photoelectric cell, for instantaneous quantitative indication and recording. (S11)

112-S. Research on Measurements of the Temperature of Molten Steel by Means of a Platinum/Platinum-Rhodium Thermocouple. (In French.) P. Bastien and J. Bleton. *Revue de Métallurgie,* v. 46, Dec. 1949, p. 807-817.

Methods and apparatus. Comparison of thermocouple and pyrometer data indicate that more accurate results are obtained when the former is used. Importance of temperature control of the molten steel. 11 ref. (S16, Fe)

113-S. Process for Determining the Melting Temperature in the Basic Bessemer Converter. (In German.) Gerhard Naeser and Werner Pepperhoff. *Stahl und Eisen,* v. 70, Jan. 5, 1950, p. 22-24.

Value of close control. Apparatus and procedure for measuring radiation at the blast tuyere by two photo-electric cells of different sensitivity. Temperature is computed electrically and recorded. (S16, D3, ST)

114-S. Concerning Resistance to Precipitation in Electro-Analytical Determinations. (In German.) Alwin Schleicher and Otmar Schlösser. *Fresenius' Zeitschrift für analytische Chemie,* v. 130, no. 1, 1949, p. 1-16.

A series of experiments shows that reactions occurring at the cathode can be used to evaluate results of precipitation methods. The method described permits calculation of variations of energy, output, and resistance, giving insight into forces which oppose the complete, rapid, and adherent deposition of the metals. (S11)

115-S. Qualitative Analysis of Nonferrous Alloys Using the "Steeloscope" With a Photometric Ocular. (In Russian.) M. M. Averbukh and I. I. Erina. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Dec. 1949, p. 1431-1434.

Attachment for spectrographic analysis which allows qualitative analysis to be completed in 2-3 min. (S11, EG-a)

116-S. Determination of Small Amounts of Calcium in Steel by Spectrographic Analysis. (In Russian.) A. G. Komarovskii. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Dec. 1949, p. 1435-1437.

Method, calibration curves and typical data. (S11, ST, Ca)

117-S. Spectrographic Determination of Large Concentrations of Antimony in Lead. (In Russian.) A. I. Alekseeva and L. E. Naimark. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Dec. 1949, p. 1437-1439.

Approximate method for 2-10% Sb. (S11, Pb, Sb)

118-S. The Determination of Oxide Lead in Ores and Concentrator Products. R. S. Young, A. Golledge, and H. L. Talbot. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 204-207.

Previously abstracted from *Mining Technology.* See item 10c-32, 1948. (S11, Pb)

119-S. A Suggested Approach to the Analysis of Mineral Suspensions by High-Frequency Electrical Measurements. John D. Morgan, Jr., and Sylvain J. Pirson. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Minerals Beneficiation Div.), v. 183, 1949, p. 276-282. (S11)

120-S. Quantitative Spectrographic Determination of Minor Elements in Zinc Sulphide Ores. L. W. Strock. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Extractive Metallurgy Division), v. 182, 1949, p. 226-247.

Previously abstracted from *Metals Technology.* See item 10-31, 1945. (S11, Zn)

121-S. Spectrographic Analysis of Special High-Grade Zinc. A. Y. Bethune and W. W. Schmittroth. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Extractive Metallurgy Division), v. 182, 1949, p. 248-260.

Previously abstracted from *Metals Technology.* See item 10-117, 1946. (S11, Zn)

122-S. The Determination of Oxide Cobalt. R. S. Young, A. J. Hall, and H. L. Talbot. *Transactions of the American Institute of Mining and Metallurgical Engineers* (Extractive Metallurgy Division), v. 182, 1949, p. 261-265.

Previously abstracted from *Metals Technology.* See item 10-114, 1946. (S11, Co)

123-S. Graphic Inspection Method

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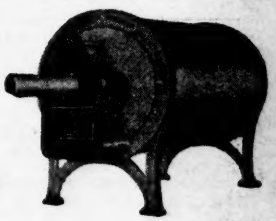

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Pin-Points Errors in Machined Parts. Fred Bohle. *Steel*, v. 126, Mar. 20, 1950, p. 85-86, 88.

Automatic recording of inspection-instrument readings which is proving valuable in checking gears and other parts with complex surfaces. (S14, T7)

124-S. Quality Control Indicator Developed by General Electric. *Better Enameling*, v. 21, Mar. 1950, p. 16, 31.

Electric calculating machine that keeps a continuous check on reject rates in production operations. (S18)

125-S. Quality Control Indicator Helps Keep Rejections at Low Levels. *Machinery* (American), v. 56, Mar. 1950, p. 155-156.

New electrical instrument developed by General Electric. (S18)

126-S. The Immersion Thermocouple. *Journal of Metals*, v. 188, Mar. 1950, p. 468B-470.

Three users report on steel bath temperature control. Procedure, advantages, and cost. (S16, ST)

127-S. Electronic Inspection Machines Accurately Sort Products for Size. Alexander Maxwell. *Machine Design*, v. 22, Mar. 1950, p. 140-142.

Equipment applied to small parts. (S14)

128-S. High-Speed Blade-Checking. *Aircraft Production*, v. 12, Mar. 1950, p. 73-75.

Application of British multidimensional checking machine to gas-turbine blades. (S14)

T

APPLICATIONS OF METALS IN EQUIPMENT

126-T. Aluminium Roofing; Details of Reconstruction Project Completed at a Warrington Works. *Sheet Metal Industries*, v. 27, Feb. 1950, p. 126-127. (T26, Al)

127-T. Aluminum Single Arch Span at Arvida. *Iron Age*, v. 165, Feb. 23, 1950, p. 88.

Canadian bridge, believed to be the first of its type. (T26, Al)

128-T. Fifty Years of Light Metal Progress in Architecture. *Light Metal Age*, v. 8, Feb. 1950, p. 8-10, 34.

Modern applications of Al in architecture. (T26, Al)

129-T. Aluminum Air-Borne Prefabs. *Light Metal Age*, v. 8, Feb. 1950, p. 11.

Prefabricated structure of aluminum panels designed to be flown to forward bases. (T26, Al)

130-T. Dramatic Application of Aluminum in British Architecture. *Light Metal Age*, v. 8, Feb. 1950, p. 12-13.

Miscellaneous examples. (T26, Al)

131-T. Aluminum Accordion Insulation. Alexander Schwartz. *Sheet Metal Worker*, v. 41, Feb. 1950, p. 37-38, 88.

Elimination of moisture traps, high insulating value, extreme light weight, and ease of installation are among the advantages claimed for unique insulation. Installation procedure. (T26, Al)

132-T. Stainless Steel for Plating Room Exhaust. *Sheet Metal Worker*, v. 41, Feb. 1950, p. 47-48. (T5, SS)

133-T. Monel and Copper on Big Truck Terminal. *Sheet Metal Worker*, v. 41, Feb. 1950, p. 52-53.

Various roof uses. (T26, Ni, Cu)

134-T. The Vincent Motorcycle. P. E. Irving. *Light Metals*, v. 13, Jan. 1950, p. 5-7; Feb. 1950, p. 70-75.

Use of Al alloys in British motorcycle. (T10, Al)

135-T. An Investigation of Die Blocks. I. (In Japanese.) Akira Adachi. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, May 1949, p. 35-39.

Chemical compositions, physical and mechanical properties of Cr, Cr-Mn, Cr-V, Cr-W, and Cr-W-V steels studied to find a substitute material of lower cost for die blocks. (T5, TS)

136-T. Research Study Evaluates Mold Liner Materials. Roy D. Haworth, Jr. *Brick & Clay Record*, v. 116, Mar. 1950, p. 67-69, 74.

See abstract from *Iron Age*, item 73-T, 1950. (T5, Q9, AY)

137-T. Alloy Steel Cuts Preparation Maintenance. *Coal Age*, v. 55, Mar. 1950, p. 78-79.

Special heat treated alloy steel plate for chute bottoms and liners is expected to save over $130,000 in operating cost during service life at New Vestaburg preparation plant of Jones & Laughlin Steel Corp. (T5, AY)

138-T. Types of Carbide Cutting Tools and Their Specific Applications. (Continued.) W. L. Kennicott. *Tool & Die Journal*, v. 15, Mar. 1950, p. 52-54, 56.

(T6, SG-j)

139-T. Tungsten Carbide Drilling on the Marquette Range. A. Eugene Lillstrom. *Skillings' Mining Review*, v. 38, Mar. 11, 1950, p. 1, 6, 14. (T28, SG-j)

140-T. Experiment Proves Value of Metal Roof Beams. Rolf W. Roley. *Mechanization*, v. 14, Feb. 1950, p. 87, 90-91.

Use of Mg alloy beams to support mine roofs. (T26, Mg)

141-T. Underground Aluminum Gas Line. *Industry & Welding*, v. 23, Mar. 1950, p. 30-31.

Pipeline made of extruded 53S-T6, 8⅝ in. o.d., and ¼ in. thick. Welding methods. (T29, K general, Al)

142-T. Tungsten Carbide Bits at the Britannia Mine. P. W. Billwiller. *Canadian Mining and Metallurgical Bulletin*, v. 43, Feb. 1950, p. 69-73; *Transactions of the Canadian Institute of Mining and Metallurgy*, v. 53, 1950, p. 49-53.

Use in drilling operations. (T28, W, SG-j)

143-T. High-Pressure Vessels for the Oil-Refining and Chemical Industries. H. B. Fergusson. *Engineering*, v. 169, Feb. 10, 1950, p. 149-150. A condensation.

Design, choice of materials, and production methods. Welding, forming, and stress-relief annealing. (T26, G general, K general, J1)

144-T. Graphite Electrodes in Electrometallurgy. (In French.) M. J. Durand. *Journal du Four Electrique et des Industries Electrochimiques*, v. 58, Nov.-Dec. 1949, p. 135-138.

Properties and utilization in electrometallurgical furnaces. (T5, C)

145-T. Pure Iron in Surface-Coating Technology. (In German.) H. Kalpers. *Metalloberfläche*, sec. A, v. 3, Dec. 1949, p. 218-219.

Corrosion and heat resistance of commercially pure iron (not over 0.15% of C, Si, Mn, S, and P combined). Applications in chemical, metallurgical, and related industries as a base for paints, plating, enamels, etc. (T29, T5, L general, Fe)

146-T. Copper and Copper-Alloy Springs. (In German.) E. Tschanter. *Metall*, v. 3, Dec. 1949, p. 424-426.

Physical properties of copper and 12 Cu alloys; procedure of manufacturing the springs; the fatigue behavior of copper and of 24 Cu binary and ternary alloys with Zn, Sn, Ni, Be, Co, Si, Mn, Cr, Al, and Fe; and the effect of temperature on their respective elasticity moduli. (T7, Cu)

147-T. Special Shapes for Small Tools. *Die Castings*, v. 8, Mar. 1950, p. 21, 62-63.

Use of Zn die castings in Speedex wire strippers. (T6, Zn)

148-T. Protection Against Wind and Rain. *Die Castings*, v. 8, Mar. 1950, p. 22-24.

Use of Zn die castings for housing of television-antenna rotator. (T1, Zn)

149-T. A Staple Design. *Die Castings*, v. 8, Mar. 1950, p. 27-28.

Body, base and plunger of paper stapler are die cast in aluminum. (T10, Al)

150-T. Use Die Castings To Put the Best Foot Forward. *Die Castings*, v. 8, Mar. 1950, p. 29.

Use of Zn die castings in coin-operated shoe-shine machines. (T10, Zn)

151-T. Precision Instruments for a Mass Market. *Die Castings*, v. 8, Mar. 1950, p. 32-34.

Use of Zn and Al die castings in rugged draft gages and air-velocity meters, used in measuring the efficiency of home heating and ventilating systems. (T8, Zn, Al)

152-T. Tubes and Scoops. *Die Castings*, v. 8, Mar. 1950, p. 36-38.

Use of die-cast Al in sausage-stuffer tubes, hand scoops, and lard paddles. (T29, Al)

153-T. Magnesium Reduces Weight of Saw. *Machine Design*, v. 22, Mar. 1950, p. 118.

Portable power saw weighing only 25 lb. yet developing 3 hp. (T5, Mg)

154-T. Graphite Electrodes. H. G. MacPherson. *Journal of Metals*, v. 188, Mar. 1950, p. 481-484.

Thermal gradients and strains during rapid cooling. Degree of thermal shock resulting when an electrode column is pulled rapidly from an electric steel furnace. Measurements to determine thermal conductivity, thermal expansion, modulus of elasticity, and strength. (T5, D5, C)

155-T. Three-Leaf Automobile Spring Built at Less Cost. A. H. Allen. *Steel*, v. 126, Mar. 20, 1950, p. 80-81, 106.

New "broadbeam" unit, designed primarily for passenger-car use which requires less labor in fabrication and assembly and has excellent mechanical features. (T7, Q5, Q28, AY)

156-T. Expanded Metal Grids Reduce Resistor Weight. *Product Engineering*, v. 21, Mar. 1950, p. 98.

In place of the wires, ribbons, or cast grids ordinarily used as heating elements, the "Multipath" resistor employs mesh-type sheet, stainless steel, or Al alloys. (T1, SG-q, SS, Al)

157-T. Approximate Relative Costs of Various Spring Materials. H. E. Machado. *Product Engineering*, v. 21, Mar. 1950, p. 161.

Chart shows relative costs vs. wire diameters for ten common ferrous and nonferrous materials. (T7, SG-b)

158-T. Longer-Lasting Materials for Truck & Bus Mufflers. *SAE Journal*, v. 58, Mar. 1950, p. 46-47. Based on "Better Exhaust Systems for Trucks and Buses", by E. E. Bryant.

Relative merits of various metals, alloys, and coatings, including aluminized steel, "zinc grip", terne plate, porcelain-coated steel, and stainless steel. (T21, SG-g, h, Al, Zn, CN, SS)

159-T. Paths to Better Engine Lubrication. *SAE Journal*, v. 58, Mar. 1950, p. 70-72. Based on "Valve, Ring,

Cylinder Sleeve, and Other Designs as Aids to Lubrication", by A. T. Colwell and A. L. Pomeroy.

Recent design and metallurgical advances in valves, pistons, and cylinder sleeves which improve engine lubrication. (T21)

160-T. Gas Turbines; High Temperature and High-Strength Steels. *Iron and Steel*, v. 23, Mar. 1950, 85-87, 98. Based largely on Chapter VII, "Gas Turbines and Jet Propulsion for Aircraft", Ed. 5, by G. Geoffrey Smith (Iliffe & Sons, Ltd., London).

Designer's requirements are considered in relation to materials now available and their properties. (T25, AY, SG-h)

161-T. Steels Employed in Die Casting Aluminium. A. Hazell. *Machinery* (London), v. 76, Feb. 23, 1950, p. 280.

Recommended compositions and heat treatment. (T5, J general, E13, AY, Al)

162-T. Aluminium for Road Vehicles. *Engineering*, v. 169, Feb. 24, 1950, p. 228.

Summarizes symposium of six papers presented in London. (T21, Al)

163-T. Investigation of Cast Irons for Resistance-Heating Elements. (In Portuguese.) Lino de Lacerda Santos and Tomio Kitice. *Boletim da Associaçao Brasileira de Metais*, v. 5, Oct. 1949, p. 461-472; discussion, p. 472-476.

A study of different ferrous alloys of the cast-iron type. Physical properties, in particular electrical conductivity of individual alloys; applicability for heating elements. (T1, P15, CI, SG-q)

164-T. (Book) A.S.T.M. Standards on Electrical Heating, Resistance, and Related Alloys. 170 pages. 1948. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

Standards for the above as well as thermostat metals, contact materials, materials for lamps and radio tubes, and structural and electrical-resistor materials for furnaces. (T1, SG-q, r, a)

V

MATERIALS
General Coverage of Specific Materials

46-V. Steel Castings Grow in Importance to the Design Engineer. Marsden R. Atwater. *Western Metals*, v. 8, Feb. 1950, p. 24-25.

Advantages and applications. (CI)

47-V. Gallium; Rare Metal Now Ready for Industry. *Modern Industry*, v. 19, Feb. 15, 1950, p. 70-71.

Unusual properties. Some potential applications. (Ga)

48-V. Technology of Aluminium and Alloys; Some Applications and Basic Properties. *Chemical Age*, v. 62, Feb. 4, 1950, p. 199-201. From *Aluminum Development Association* (London), Bulletin No. 16. (Al)

49-V. Copper and Copper Alloys; Technical Progress in 1949. E. Voce. *Metallurgia*, v. 41, Jan. 1950, p. 150-152.

Joining, corrosion, recrystallization, grain growth, and applications. 107 ref. (Cu)

50-V. Study on the Materials for Valve Seats at High Temperature and Pressure. I-II. (In Japanese.) Mitsuru Okano and Hideji Hotta. *Nippon Kinzoku Gakkai-Si* (Journal of the Japan Institute of Metals), v. 13, May 1949, p. 27-30; Aug. 1949, p. 49-52.

Part I: Investigations of the thermal expansion, hardness, corrosion, machinability, abrasion, and microscopic characteristics of Co-Cr-W steels, cast iron of the Si-Mn-Ni-Cr series, 13% Cr steel, and carbon steel. Part II: Investigations of abrasion, galling at high temperature, and corrosion resistance of the same alloys to 3% NaCl; 1, 20, and 40% HCl; 1, 20, and 40% HNO_3; and 1, 20 and 96% H_2SO_4. 24 ref. (SG-h, T7)

51-V. New Precipitation-Hardening Stainless Steels. G. N. Goller and W. C. Clarke, Jr. *Iron Age*, v. 165, Mar. 2, 1950, p. 86-89; Mar. 9, 1950, p. 79-83.

Armco's two new Cr-Ni stainless steels, 17-4 PH and 17-7 PH, employ Cu and Al as precipitation-hardening elements instead of carbide formers. These steels are said to have excellent corrosion resistance plus high strength properties. Physical and mechanical properties; amenability to hot forging, machining, welding, heat treating, cleaning and finishing, and potential applications. (SS)

52-V. The Present Status of Titanium Metal. Felix B. Litton. *Journal of the Electrochemical Society*, v. 97, Mar. 1950, p. 66C-68C.

Production and fabrication methods, properties, and applications of Ti and its alloys. (Ti)

53-V. The Platinum Metals: A Review of Their Properties and Uses. Edmund M. Wise. *Journal of the Electrochemical Society*, v. 97, Mar. 1950, p. 57C-64C.

21 references. (EG-d)

54-V. Cemented Carbide Materials—Their History and Development. W. H. Bleecker. *Tool & Die Journal*, v. 15, Mar. 1950, p. 58-60, 62.

Production, microstructure, mechanical properties, etc. (SG-j)

55-V. Lithium in Modern Industry. *Foote Prints*, v. 21, no. 2, 1950, p. 4-28.

Future prospects, chemistry, reactions of metallic lithium, industrial lithium salts and their uses, lithium grease patents and references, and new applications of lithium salts. Includes several bibliographies. 136 ref. (Li)

56-V. Nodular Iron; A New Engineering Material. F. H. Allison, Jr. *United Effort*, v. 30, Jan.-Feb. 1950, p. 6-8.

Properties, production, structure, and applications. (CI)

57-V. Steel. Wilfred Sykes. *Midwest Engineer*, v. 2, Mar. 1950, p. 3-7.

Properties, research developments, production, ore reserves, and governmental policies affecting the industry. (ST)

58-V. Nodular Iron. F. R. Morral. *Foundry*, v. 78, Mar. 1950, p. 135.

A brief digest of published data. (CI)

59-V. Advances in the Metallurgy of Cast Iron. Clyde O. Penney. *Mines Magazine*, v. 40, Feb. 1950, p. 12-17.

Three recent developments considered of major importance: use of oxygen in the cupola, use of radioactive isotopes in metallurgical research, and production of nodular graphite structures. Describes the latter at some length. 12 ref. (CI)

60-V. A Study of Some Alloys of Titanium in the Manufacture of Which Commercial Titanium Hydride Powder Was Used. W. E. Kuhn, H. V. Kinsey, and O. W. Ellis. *Canadian Mining and Metallurgical Bulletin*, v. 43, Feb. 1950, p. 74-87; *Transactions of the Canadian Institute of Mining and Metallurgy*, v. 53, 1950, p. 54-67.

Deals with binary alloys of Ti containing up to about 10% Cr, Co, Fe, Mn, Mo, Ni, and W. Method of production; results of transverse strength, tensile, and creep rupture tests; forgeability tests; metallography, deformation, and microstructure; and oxidation resistance. (Ti)

61-V. Vanadium and Its Alloys; A Review of Previous Work. W. B. Pearson. *Journal of the Iron and Steel Institute*, v. 164, Feb. 1950, p. 149-159.

The chemical and physical properties of vanadium, particularly in relation to the use of controlled atmospheres and refractory materials for containing the metal at high temperatures. Determinations of lattice constant. Four methods of preparing the metal. Alloy systems are described under three main headings: alloys with O_2, N_2, C, and H_2; the ferrovanadium alloys; and alloys with various other elements. 101 ref. (V)

62-V. Tantalum. G. L. Miller. *Murex Limited Review*, v. 1, no. 5, 1949, p. 88-96.

Occurrence, recovery, powder production, processing, properties, and applications. 18 ref. (Ta)

63-V. The Potentialities of Aluminium and Its Alloys for the Papermaking Industry. F. W. Rogers. *Proceedings of the Technical Section, Paper Makers' Association of Great Britain & Ireland*, v. 29, Dec. 1948, p. 383-404; discussion, p. 405-408.

Properties, behavior, working methods, and typical applications. (T29, Al)

64-V. Aluminum Bronze in the Foundry. (In Italian.) *Alluminio*, v. 18, Nov.-Dec. 1949, p. 635-657.

A comprehensive review of methods of production, casting, and heat treatment, and physicochemical properties of Al bronzes (5.0-15% Al, 0.5-5% Ni, 0.5-4% Mn, and 1.0-6.0% Fe, balance Cu). Optimum conditions of fabrication and application for each type. Physical, mechanical, and chemical properties are tabulated. (E general, Cu)

65-V. The Uses of Magnesium Alloys in Modern Industry. (In German.) W. Bulian. *Metall*, v. 3, Dec. 1949, p. 415-417.

Uses and limitations. Mechanical properties of 16 different alloys are tabulated. 20 ref. (T general, Q general, Mg)

66-V. Properties and Possible Uses of Lead-Arsenic Alloys in Comparison With Lead-Antimony Alloys. (In German.) O. Emieke. *Metall*, v. 4, Jan. 1950, p. 1-5; Feb. 1950, p. 48-53.

Comparative investigation of mechanical, structural, and fabrication properties of Pb-rich alloys of the above groups. Application for chemical-tank linings and for electrical and telephone cables. 15 ref. (T29, T1, Pb)

67-V. Lead Bronze as a Bearing Alloy. (In Czech.) Josef Valter. *Hutnické Listy*, v. 4, Dec. 1949, p. 381-386.

Properties and applications of various compositions. (SG-c, Cu)

68-V. Pure Nickel & Cupro-Nickel Alloys for Coinage. D. A. Ferguson. *Science & Engineering*, v. 2, Nov. 1949, p. 197-200.

History of coinage, desirable properties of coinage metals, resources of Ni and Cu-Ni alloys, properties, and forming procedures. (T10, Ni, Cu)

69-V. Chrome Magnet Steel. L. H. Seabright. *Iron Age*, v. 165, Mar. 16, 1950, p. 90-92.

Care in casting, working and annealing is needed for optimum magnetic characteristics and workability. Tests show importance of proper heat treatment of a 3.5% Cr steel. Hardness and effect of various factors on magnetic properties are tabulated. (J23, J26, P16, SG-n, AY)

70-V. Ferro-Alloys in 1949. R. G. Knickerbocker. *Journal of Metals*, v. 188, Mar. 1950, p. 476B-476D.

(Continued on page 45)

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, O., unless otherwise stated.

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POSITIONS WANTED

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METALLURGICAL ENGINEER: Graduating from the Colorado School of Mines in June 1950 with a metallurgical engineering degree. Age 24, single, veteran. Interested in nonferrous process development of finished castings. Experience in routine analysis of ferrous and nonferrous alloys. Box 4-30.

METALLURGIST: S.M. in metallurgy from Massachusetts Institute of Technology. Three years experience in sales and development work in precision casting line; two years administrative experience; two years general metallurgical experience. Available for position where initiative, enterprise and a positive personality are needed as well as technical ability. Imaginative but practical. Salary $6000 minimum. Box 4-35.

SALES ENGINEER—METALLURGIST: B.S. in chemical engineering from eastern university. Age 38, married. Fifteen years sales and responsible metallurgical experience with alloy steel products and fabrication of machinery and aircraft parts. Excellently qualified to produce immediate results in sales, purchasing, or administration of progressive company. Box 4-40.

CHEMICAL ENGINEER AND METALLURGIST: B.S. in chemical engineering from Massachusetts Institute of Technology, 1942. Veteran, married, age 28. Three years experience as assistant to chief metallurgist in production control and laboratory work in large gray iron foundry. Willing and able to learn and assume responsibility. Desires permanent position with bright future. Box 4-45.

GRADUATE METALLURGIST: With formal education in industrial statistics. Several years experience in metallurgy including quality control, research, production problems. Background in steel production and metal fabrication. Desires position with good future. Box 4-50.

METALLURGICAL ENGINEER: B.S. in metallurgical engineering, 1949. Age 25, married, one child, veteran. Experience in quality control, development and investigation of customer complaints. Especially desires position with progressive company in any phase of steel industry. Presently employed in nonferrous industry. Box 4-55.

METALLURGICAL ENGINEER: M.S. Four years university teaching — metallurgy and mechanical engineering. Two years research in physical chemistry. Two years plant metallurgist. Several technical articles. Best references. Now located in western New York but will relocate. Desires permanent employment. Box 4-60.

METALLURGICAL ENGINEER: B.S. from Carnegie Institute of Technology. Seventeen years extensive experience with nonferrous mill products, including research, production, development and sales engineering. Four years as chief metallurgist. Desires position as chief metallurgist or assistant, development or customer contact metallurgist. Location desired — Pennsylvania, Ohio or East. Complete details of experience on request. Box 4-65.

METALLURGIST: Age 56. Twenty-five years experience in ferrous metallurgy including metallurgical laboratory and production control. Blast furnace, electric furnace, openhearth, bessemer and foundry experience. Presently in U.S. Government service. Graduated from mining and metallurgical college in Sweden and naturalized American citizen. Desires work as plant metallurgist or any other related position with responsibility. Box 4-70.

METALLURGICAL ENGINEER: Graduate June 1950, University of Idaho. Desires permanent position in manufacturing, production, or allied field on the West Coast. Journeyman sheet metal worker before entering college. Experienced in layout and fabrication. Age 25, veteran, married. Member Sigma Gamma Epsilon honorary fraternity. Interested in opportunity for advancement. Box 4-75.

PRODUCTION METALLURGIST: M.S. in metallurgy. Age 30, married. Seven years experience in metallurgical control, development, production of wire, cable and sheet in aluminum rolling mills. Experience includes melting, casting ingots, rolling, heat treatment, inspection and physical testing. Designed and installed equipment. Now employed in supervisory administrative position. Desires position as production metallurgist or supervisor. Box 4-80.

ASSISTANT ADMINISTRATOR: Broad experience in organizing and administering metallurgical inspection department of South American steel plant. Responsible for metallurgical control of all steel mill processes. Has written operating practices and steel specifications. Also some experience with carbon, alloy and stainless steel production in this country. Prefers small or medium-sized company. Box 4-85.

METALLOGRAPHER-METALLURGIST: Age 33, married. Eight and one-half years experience including 4½ years with aircraft engine manufacturer, one in electrical transportation equipment field and three with refrigerator and freezer organization as metallurgist and metallographer in materials and works laboratories on shop problems, heat treatment, fabrication, failure analyses, material acceptance, materials coordinator, vendor contact, photomicrography. Desires position with medium-sized company, preferably in Midwest. Box 4-90.

METALLURGIST: Age 31, married, two children. B.A.Sc. in metallurgy from University of Toronto, 1950. Four years mining experience. Prefers position in a fabricating industry with a training program leading to a responsible position. Would like to spend several years in South America. Box 4-95.

GRADUATING METALLURGIST: University of Notre Dame, June 1950, B.S. Age 24, married, one child, veteran. Interested in research, sales and development. One and one-half years experience as part-time laboratory assistant in gray and white cast iron foundry. Location not important. Box 4-100.

METALLURGICAL ENGINEER: Age 34, family. Twelve years experience in ferrous and nonferrous metallurgy, including testing, development, process metallurgical control, quality control, and customer services. Familiar with fabricating methods for light alloys, particularly aluminum. Desires position in production or customer services. Employed in responsible metallurgical position but desires change. Box 4-105.

METALLURGICAL ENGINEER: Age 29, married, one child. B.S. in Met. Eng., Carnegie Tech. Seven years of diversified experience in metallurgical research, development and engineering; practical knowledge of mechanics and electricity. Desires responsible position with a progressive organization as product engineer or as technical assistant to an administrative or engineering executive. Box 4-135.

METALLURGIST: Member of graduating class, University of Notre Dame. Some foundry experience. Age 28, married. Desires position in production or research metallurgy. Location no limitation. Available in June. Box 4-140.

METALLURGICAL ENGINEER: M.S., B.S. Age 30, married. Four years experience materials testing laboratory; one year brass mill, including supervision, failure investigation of aircraft engines, and extrusion technique. Training covers physical metallurgy and welding. Now doing postgraduate work, but available immediately. Desires research or development work in midwest. Box 4-145.

AMBITIOUS MAN: Economy minded, has 30 years to give to open-minded, farseeing light metals industry in New Mexico or Southwest. Technical and supervisory capacity for progressive job management, worker efficiency and morale. Prefers recent development. Available for interview in early summer. Box 4-150.

METALLURGICAL ENGINEER: B.S., M.S. (June 1950). Age 28, married, one child. Excellent research and development background in electronics and vacuum tube industry. Knowledge of vacuum tube techniques, high-vacuum furnaces and equipment, X-ray. Five years experience in deep drawing and construction of vacuum tube parts. Present research on metal-ceramic bonding. Excellent references. Available July 1. Box 4-155.

TECHNICAL COPY WRITER: Engineering B.S. Ten years experience; specialization in technical catalogs, bulletins, magazine articles and trade shows. Capable of handling advertising budgets and advertising production. Especially qualified in metallurgical field. Will relocate on 30 days notice. Box 4-160.

METALLURGICAL ENGINEER: M.S., age 31, married, two children. Army veteran, registered professional engineer. 6½ years varied experience; last 2½ years directly responsible for XRD and metallurgical laboratory equipment and techniques in large high-temperature materials labora-

(Continued on page 45, column 3)

A. S. M. REVIEW OF METAL LITERATURE

(*Continued from page 43*)

New technological and economic developments concerning the production and uses of Mn found in slags; recovery of low-grade Cr ores; and uses of exothermic alloys; and of Co, Ni, Mo, W, Cb, Ta, V, and Ti in the ferro-alloy industry. (B22, Fe)

71-V. Titanium Binary Alloys. C. M. Craighead, O. W. Simmons, and L. W. Eastwood. *Journal of Metals; Transactions of the American Institute of Mining and Metallurgical Engineers,* v. 188, Mar. 1950, p. 485-513.

Alloys of Ti with Ag, Pb, Sn, Ni, Cu, Be, B, Si, Cr, Mo, Mn, V, Fe, and Co were studied. Preparation of ingots. Tensile properties, minimum bend radii, hardnesses, response to heat treatments and aging treatment, and phase relationships. (Q general, M24, Ti)

72-V. Ternary Alloys of Titanium. C. M. Craighead, O. W. Simmons, and L. W. Eastwood. *Journal of Metals; Transactions of the American Institute of Mining and Metallurgical Engineers,* v. 188, Mar. 1950, p. 514-538.

Results of a preliminary study of 113 alloys. Structure and transformation range. Tensile properties, minimum bend radii, hardnesses, response to heat treatment and aging treatment, and phase relationships. (Q general, M24, Ti)

73-V. Quaternary Alloys of Titanium. C. M. Craighead, O. W. Simmons, and L. W. Eastwood. *Journal of Metals; Transactions of the American Institute of Mining and Metallurgical Engineers,* v. 188, Mar. 1950, p. 539-552.

84 alloys from the systems Ti-Cr-C-N; Ti-Cr-C with Cu, V, Mo, Mn, Fe, or Ni; and Ti-Cr-N with V, Mo, or Ni were studied. Structure and transformation range; tensile properties; minimum bend radii, hardnesses, response to heat treatment and aging treatment, and phase relationships. (Q general, M24, Ti)

74-V. Nimonic Alloys. *Aircraft Production,* v. 12, Mar. 1950, p. 77-78.

Notes on the annealing and pickling of 75 and 75F and the hot working of 80 and 80A Ni alloys. (J23, L12, F general, Ni)

75-V. Report of the Commission on Boron Steels of the ISRID. Part I. Literature Review of Foreign Work on Steels Containing Very Small Amounts of Boron. (In French.) *Revue de Métallurgie,* v. 46, Dec. 1949, p. 859-868.

Effects of boron on various physical, mechanical, chemical, structural, and workability characteristics. 35 ref. (To be continued.) (AY, B)

76-V. (Book) An Outline of Aluminum. 64 pages. 1949. Aluminum Co. of America, Gulf Bldg., Pittsburgh.

History, mining, production, fabrication, properties, and applications. (A1)

77-V. (Book) The Non-Ferrous Metal Industry in Germany During the Period 1939-1945. Leslie Aitchison and Voya Kondic. 198 pages. 1949. His Majesty's Stationery Office, London (B.I.O.S. Surveys, Report No. 23).

Scientific, technical, and industrial information on German wartime activities in the nonferrous metals. (EG-a)

At Worcester Chapter Meeting

Photographed at a Recent Meeting of the Worcester Chapter A.S.M. Are (Left to Right): Chester M. Inman, Chairman Emeritus of the Chapter; William Mounce of International Nickel Co., Who Spoke on "Nickel Steels in Industry"; J. Robert Eves, Technical Chairman of the Meeting; and Orum R. Kerst, Chapter Chairman. Mr. Mounce's address was reported in the January issue, page 55. (Photograph by C. Weston Russell)

Sustaining Members Have Exhibits at Meeting

Reported by Arthur C. Willis

Instructor
Southern Methodist University

The first annual Sustaining Members' Night of the North Texas Chapter A.S.M. was held on March 15 in Dallas. On this occasion each sustaining member was allotted approximately 10 sq.ft. of floor or table space for the placement of a display. Under a placard bearing the sustaining member's name appeared a selection of parts manufactured or sold by the member, pictures, advertising literature, or suitable combinations of such arrangements. In lieu of a display, Consolidated Vultee Aircraft Corp. exhibited a 15-min. sound movie on the B-36 airplane entitled "Target: Peace".

Speaker of the evening was Douglas B. Martin, sales manager for Amplex Division of Chrysler Corp. His subject was "Recent Progress in Powder Metallurgy".

After presenting a film strip on the manufacture and uses of powdered metal products, both ferrous and nonferrous, he spoke briefly emphasizing the advances made in the technology involved. He then answered a large number of questions on powdered metal products propounded by his listeners.

To Represent Heppenstall

W. P. Wooldridge Co., 1060 Howard St., San Francisco 3, Calif., is now representing Heppenstall Co. of Pittsburgh, in California, Montana, Idaho, Utah, Nevada, Arizona and New Mexico. The Wooldridge organization has taken over this territory from Great Western Steel Co., who had been handling Heppenstall die blocks, roll sleeves, shear and chipper knives and materials handling tongs in these states. An adequate stock will be maintained in California for the convenience of Heppenstall customers.

EMPLOYMENT

(*Continued from page 44, column 3*)

tory with direction of several research projects. Desires position in teaching and/or leading fundamental research group. Box 4-165.

METALLURGICAL ENGINEER: B.S. in Met. Eng., Illinois Institute of Technology, June 1950. Age 25, unmarried, Army veteran. Desires to train for future responsible position in technical sales, quality control, or production. Location immaterial. Available June 10. Box 4-170.

EXECUTIVE METALLURGIST: Graduate met. engr. Seven years diversified experience, 4 as chief metallurgist and chief engineer with leading manufacturers. Wide knowledge of fabrication, heat treatment and quality control of both ferrous and nonferrous metals, including powder and precious metals. Presently employed but desires position with progressive firm where initiative and thoroughness will be recognized. Box 4-175.

FOUNDRY METALLURGICAL ENGINEER: Eight years of practical experience in all phases of foundry metallurgy and foundry operation. Thoroughly familiar with melting, gating, sand, quality and process control, and the decrease of foundry defects for gray iron and aluminum castings. Extensive experience in physical testing, sand testing, and metallographic laboratory work. College graduate, age 31, excellent recommendations. Box 4-180.

CHAPTER MEETING CALENDAR

CHAPTER	DATE	PLACE	SPEAKER	SUBJECT
Akron	May 10	University Club	R. W. Thompson	Modern Forging Practice
Baltimore	May 9	Engineers Club	A. E. Focke	Mechanical Testing
Birmingham	May 2	Hooper's Cafe		Installation of Officers
Boston	May 5	Draper Corp.	Carl A. Zapffe	Stainless Steels
Buffalo	May 11	Bethlehem Supervisors' Club		Election of Officers
Calumet	May 9	Phil Smidt & Son, Whiting, Ind.	Frederic O. Hess	Heat Transfer
Chicago	May 8	Furniture Mart Bldg.	R. M. Brick	Metallurgical Education—Theoretical or Practical
Cincinnati	May 12			Election of Officers
Cleveland	May 1	Tudor Arms Hotel	R. Schneidewind	Recent Progress in Cast Iron
Columbus	May 9	Fort Hayes Hotel	J. B. Austin	Nondestructive Testing (Election of Officers)
Dayton	May 10	Engineers Club	Samuel Epstein	Deep Drawing Steel
Des Moines	May 9	Younker Bros.		Annual Meeting
Detroit	May 8	Rackham Bldg.	H. B. Knowlton	Selection of Steels and Service Performance of Steel Parts
Ft. Wayne	May			Social Meeting
Hartford	May 11	The Hedges, New Britain, Conn.	A. E. Focke	Radio-Isotopes in Metallurgy
Indianapolis	May 15	McClarney's	Lee Busch	Powder Metals
Inland Empire	May 12	Washington State College, Pullman	J. R. Spielman	Extractive Metallurgy of Vanadium
Los Angeles	May 25	Rodger Young Audit.	G. B. Berlein	Heat Treating Principles as Applied to Products
Louisville	May 2			Installation of Officers
Mahoning Valley	May 9			Plant Visitation
Milwaukee	May 16	City Club		Annual Party
Montreal	May 17			Ladies' and Past Chairmen's Night
Muncie	May 9	Muncie Central High School		Ladies' Night
New Haven	May 12	Hotel Taft	Vivien Kellems	New England Regional Meeting
New Jersey	May 15	Essex House, Newark	John W. Campbell	Rockets
New York	May 8	Building Trades Club	R. P. Loveland A. R. Black J. H. Dedrick	Recent Developments in Metallography Wear of Metals Refractory Materials
North Texas	May 17	Dallas	R. O. Fehr	Noise and Vibration Problems
North West	May 18	Covered Wagon	R. B. Johnson	Jet Propulsion and High-Temperature Metals
Northwest Pa.	May 18	Erie, Pa.		Ladies' Night
Notre Dame	May 10	Engineering Audit., Univ. of Notre Dame	Fredrick Strieter	Treatment of Cast Iron With Magnesium
Oak Ridge	May 17		R. B. Mears	Corrosion
Ontario	May 5	Royal York Hotel, Toronto	Jay Harris	Metal Cleaning
Ottawa Valley	May 2	Bureau of Mines	Samuel Bradbury, 3rd	Powder Metallurgy
Peoria	May 8	Morton, Ill.	L. P. Tarasov	Metallurgical Aspects of Grinding
Philadelphia	April 28	Engineers Club	F. G. Tatnall	Testing, Up-to-Date and Simplified
Pittsburgh	May 11	Roosevelt Hotel	Morris Cohen	Retained Austenite
Purdue	May 16	Lincoln Lodge	M. E. Mundel	Time Study
Rochester	May 8			Annual Meeting
Rockford	May 24	Faust Hotel	H. A. Schwartz	Manufacture and Properties of Malleable Cast Iron and Cast Steel
Rocky Mountain	May 18 May 19	Denver Pueblo		Election of Officers
Rome	May 1		Wm. T. Bean	Stress Analysis in Action
Saginaw Valley	May 16		Wm. J. Hale	The Demise of Obnoxious Gasoline
St. Louis	May 19	Forest Park Hotel	Leon B. Rosseau	Heat Treatment by Salt Bath
Southern Tier	May 8	Hotel Frederick, Endicott, N. Y.	J. W. Ryan	The Bendix Starter
Springfield	May 15	Hotel Sheraton	T. C. DuMond	Selection of Engineering Materials
Terre Haute	May 1	Indiana State Student Union	H. A. Lockhart	Radiant or Panel Heating
Texas	May 2			
Toledo	May 25	M. R. Y. C.		Home Talent Night
Tri-City	May 16	Rock Island Arsenal Cafeteria	Ralph A. Clark	Metallurgy of Ferrous Castings
Utah	April 27	Salt Lake City	F. J. Robbins	National Officers Night
Washington	May 8	Dodge Hotel	A. E. Focke	Mechanical Testing for Service Applications
West Mich.	May 15		C. J. Horger	Stress Analysis
Worcester	May 10	Aurora Hotel	Gordon Rideout	Abrasive Applications
York	May	Lancaster, Pa.		Annual Meeting

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